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Side Wheel Steamer City of Detroit III

CITY OF DETROIT III PASSING SANDWICH IN THE DETROIT RIVER ON HER TRIAL TRIP

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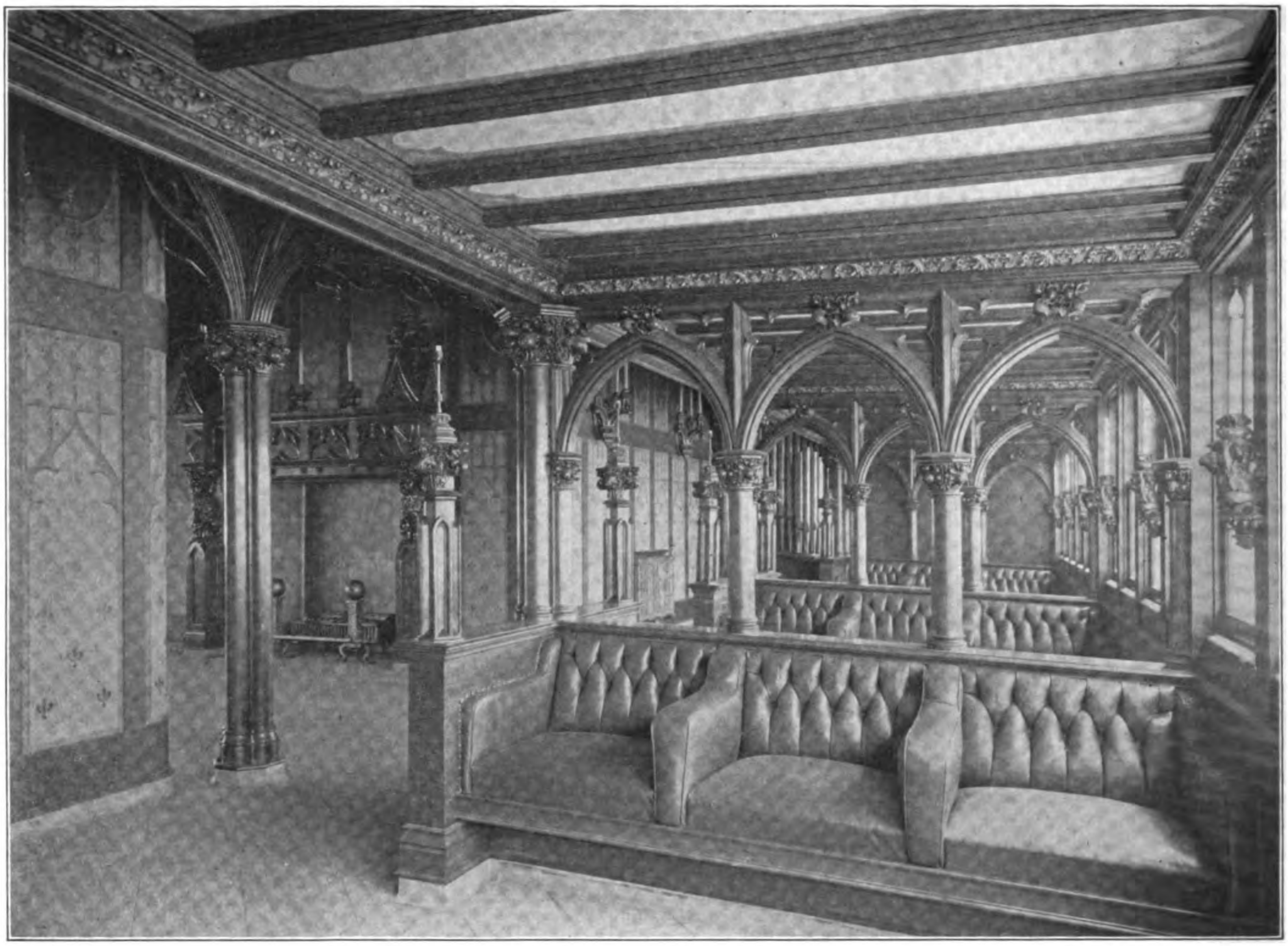
The new steamer City of Detroit III, which went into commission last month between Detroit and Buffalo, is not only the largest sidewheel passenger steamer in the world, but it is unquestionably the finest. It was considered when the City of Cleveland III came out four years ago that the designer and decorator had spent the entire resources of their arts upon her; but in the various forms of comfort, convenience and elegance the City of Detroit III is far superior to her sister. Both the Detroit Ship Building Co. and the Detroit & Cleveland Navigation Co. are certainly to be congratulated upon this latest product. Of course, the Detroit Ship Building Co. has another steamer somewhat larger under way for the Cleveland & Buffalo Transit Co., and it now remains to be seen what profit they can derive from this latest example.

The City of Detroit III went on her owner's trial on June 8. Contrary to the practice of the company, only those directly interested in her machinery and auxiliaries were aboard. The data sheet accompanies this article. The run from Southeast Shoal to Long Point, a distance of 133¼ miles, was made in six hours and 20 minutes, an average of 21.05 miles per hour, the total horsepower developed being 7,606. No data was taken as to the maximum speed as no time was afforded to set the Nicholson log and its diagram was, therefore, misleading. One of the safety valves blew off at 140 lb., and it is clear, therefore, that she can do much better than 21 miles under a full head of steam. On the return trip she was steered with the Akers auxiliary steam steerer, the shift from the regular gear being made in four seconds.

She is considerably larger than the City of Cleveland, as the following particulars show:

City of Detroit III: Length over all, 470 ft.; keel, 455 ft.; breadth, 55 ft. 4 in.; depth, 22 ft.
City of Cleveland III: Length over all, 402 ft.; keel, 390 ft.; beam, 54 ft.; depth, 22 ft.

Her hull is constructed of mild steel with double bottom divided into 11 compartments by watertight cross-bulkheads extending from keel to main deck. The bottom is divided at the center line and athwartships into 15 watertight tanks, which can be used to vary trim and draught by means of water ballast, for the control of which powerful pumps are fitted. There are two decks below the main deck and three above. A steel superstructure is carried to the main deck, though the ceiling of the saloon deck is sheathed with galvanized iron, practically making her entire housing up to the saloon deck fireproof. A steadying tank of 100 tons capacity is provided amidships to check rolling in a heavy sea.



Gothic Room City of Detroit III

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Everything that ingenuity can suggest for the safety and convenience of passengers is incorporated in the City of Detroit III. Passengers will appreciate the running hot and cold water which is supplied to every stateroom and throughout all parts of the ship. An automatic fire alarm reaches all departments. This alarm or thermostat consists of a small hollow copper wire which is connected with a sensitive diaphragm or plate, the latter sounding the alarm. The wire is installed in staterooms and other sections of the steamer in such a manner that it is exposed so that a certain degree of heat causes it at once to sound an alarm. The wire is so small that it can be placed over molding and around fancy scroll work such as is in the staterooms. The entire boat is divided into sections, eight staterooms to a section, under the plan of the new system, and when the alarm of fire is sounded an indicator or annunciator shows in what section of the boat the fire is. The wire is sensitive only to heat registering 140 degrees or more and even becomes susceptible to the heat of a burning newspaper held near it. In addition, fire walls have been installed by which, in case of fire, sliding asbestos-faced doors are shoved out, confining the fire to that particular portion of the boat. The steamer is additionally protected from fire by a complete sprinkler system, leading to the freight deck, main saloon and wing passages, the water being supplied by an 8-in. Worthington centrifugal pump driven by a 100 H. P. Terry turbine.

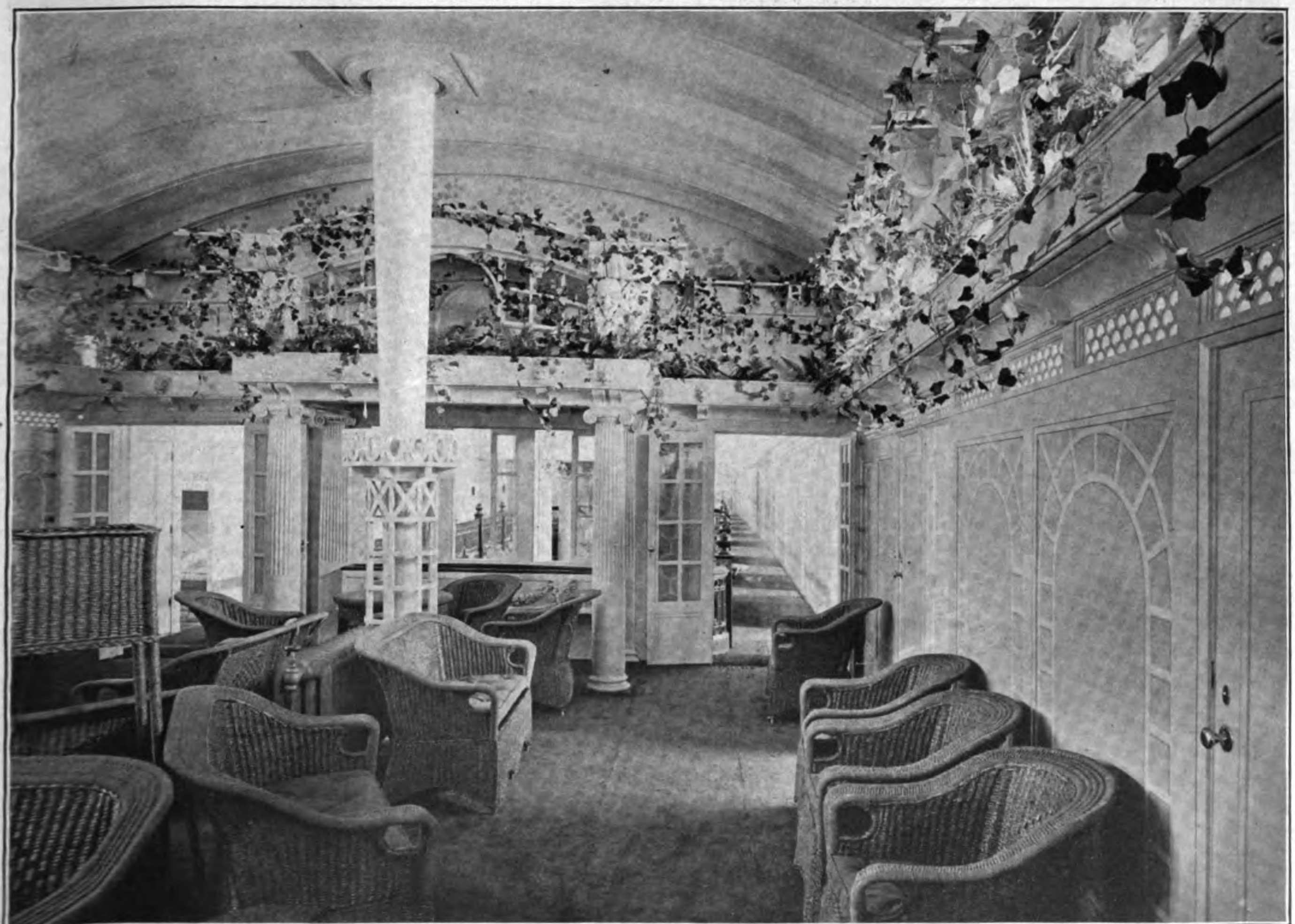
There are four sets of McCreery Engineering Co.'s air washers which furnish washed air to the inside staterooms, making them as comfortable and desirable as outside staterooms, as well as furnishing it to the crew's living spaces and the galley.

The Propelling Machinery

The propelling engine is of the inclined, three-cylinder, compound jet condensing type, having one high pressure and two low-pressure cylinders. In design it is exactly similar to the engine of the City of Cleveland, which has given such eminent satisfaction for the past five seasons, but is enlarged slightly to give the increased horsepower required. The estimated I. H. P. is 8,000 at 30 r. p. m. The high pressure cylinder is 62 in. in diameter and is placed between the two 92-in. diameter low-pressure cylinders, all having a common piston stroke of 8 ft. 6 in. The high-pressure cylinder is fitted with poppet valves and Seckles cut-off gear, while the low-pressure cylinders have Corliss valve and gear. All the valves are operated by ordinary double bar Stevenson link motion and the cut-off in each cylinder has a range of from one-fourth to three-fourths of the stroke, adjustable from the starting platform.

None of the cylinders are steam jacketed but, together with the two large tank receivers, are well insulated. The pistons are of cast steel, conical and of single thickness and are fitted with cast iron spring and junk rings. The piston rods, crossheads, connecting rods, guide struts and crank shaft are all of the highest quality steel forgings, supplied by the Midvale Steel Co. The crank shaft is 25 in. in diameter in the engine bearings and 27½ in. diameter at the outer bearings, 71½ ft. long from end to end and weights 103½

La Salle Window in Gothic Room of City of Detroit III.



Palm Court, Forward, City of Detroit III

STAIRWAY LEADING TO GALLERY DECK, FORWARD, CITY OF DETROIT III

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tons. It is made in three sections connected by flanged couplings which are recessed into the hubs of the crank arms. The crank arms are sunk into the pins, thus making the crank shaft perfectly rigid from end to end and avoiding all the trouble incidental to loose pins, wedges, etc. The crank shafting and pins are hollow throughout.

The connecting rods are 20 ft. center to center and 13½ in. diameter at the center of their length. The crank pin end is fitted with round brasses lined with white metal, the caps being forged steel worked out of the main forging. The crosshead end is forked and fitted with flat-bottomed brasses and wrought steel caps and bolts. Each connecting rod weighs approximately 10 tons. The piston rods are 12 in. diameter and the crosshead slippers are steel castings faced with white metal. The main bearing pedestals, six in number, are massive steel castings, rigidly bolted to the foundations, which are part of the ship structure, and braced together to insure stiffness when the engine is working. The caps are steel castings, box section, the bearings being circular shells lined with white metal. The guide struts are connected to the main bearing castings by a T-end through which the main bearing bolts are extended, and to the cylinder by round flanges and bolts. Midway in their length they are supported by vertical columns carried from the ship's floors. Each cylinder is cast complete with its valve chests, thus avoiding all unnecessary and oftentimes troublesome joints. The front heads are also cast with the cylinders and are strongly ribbed to distribute the strain from the guide struts. The finished low-pressure cylinders weigh approximately 27¾ tons each and are excellent specimens of the founders' art.

The main air pumps, two in number, are of the vertical, single-acting plunger and bucket type, driven through heavy forged steel bell crank levers, from the low-pressure crossheads. Each air pump crosshead also carries the plunger of a single-acting vertical feed and bilge pump.

The condensers are built up of riveted plate and each low-pressure cylinder connects with its own condenser through a 24-in. exhaust pipe.

The reversing of the engines is accomplished by means of a direct-acting steam gear, but a powerful hand-operated worm reversing gear is fitted for emergency use.

The handling gear levers are all conveniently grouped in a quadrant on the working platform above the cylinders and, massive though the moving parts are, the reversing, etc., is accomplished with the greatest ease and facility. The main throttle valve, 17 in. in diameter, is of the Schuette-Korting balanced type, operated by a simple lever and is fitted with an 8-in. "by-pass" or maneuvering valve which is sufficiently large to operate the engine up to half speed. The lubricating system is elaborate and complete, as are the appliances to assist in the overhauling or lifting of the engine parts. The paddle wheels are unusually strong and heavy and are designed to successfully meet the severe ice conditions met with in the early part of the season. The centers are of cast steel and the arms of forged iron with the large gudgeon bosses forged on and bushed with lignum-vitae. The wheels are 30 ft. 3 in. outside

GRAND SALON, LOOKING AFT, CITY OF DETROIT III — *Copyrighted, Detroit Publishing Co.*

diameter, each fitted with 11 curved steel buckets 14 ft. 6 in. long by 5 ft. wide. The radius rods are of forged steel fitted with brass bushings. The outboard bearings are heavy steel castings, lined with white metal, and are adjustable in vertical and fore and aft directions.

Steam at 160 lb. per sq. in. pressure is supplied by six cylindrical return-tube boilers of the following dimensions: One single-ended, 13 ft. 9 in. diameter by 12 ft. long, with two 52-in. diameter Mouson furnaces; one double-ended, 13 ft. 9 in. diameter by 22 ft. long, with four 52-in. diameter Mouson furnaces; two single-ended, 14 ft. 8 in. diameter by 12 ft. long, with three 44-in. diameter Mouson furnaces; two double-ended, 14 ft. 8 in. diameter by 22 ft. long, with six 44-in. diameter Mouson furnaces, making six 52-in. diameter, and 18 44-in. diameter furnaces, or 24 in all. The grates are all 5 ft. 6 in. long and the boiler tubes are 24 external diameter. The boilers are placed in two batteries of three each, and are fired in a fore and aft direction, the coal being carried in three athwartship bunkers. The Howden system of heated air forced draft

TRIAL TRIP OF CITY OF DETROIT III.

Hull.—Length, keel, 455 ft.; overall, 470 ft.; breadth, 55 ft. 4 in.; depth, 22 ft.

Engine.—Inclined, three-cylinder compound, 64 in., 92 in. x 8 ft. 6 in. stroke.

Boilers.—One single end, 13 ft. 9 in. x 12 ft.; two 52-in. furnaces.
Two single end, 14 ft. 8 in. x 12 ft.; three 44-in. furnaces.
One double end, 13 ft. 9 in. x 22 ft. 7½ in.; four 52 in. furnaces.
Two double end, 14 ft. 8 in. x 22 ft. 7½ in.; six 44 in. furnaces.
Working pressure, 160 lbs. All grates 5 ft. 6 in. long.
Total grate surface, 506 sq. ft. Ratio 47.68.
Total heating surface, 23,673 sq. ft. Ratio 47.68.
Howden draft; three No. 9 Sirocco blowers direct connected to double 7 in. x 7 in. engines.

Heater.—One Schuette & Koerting film type.

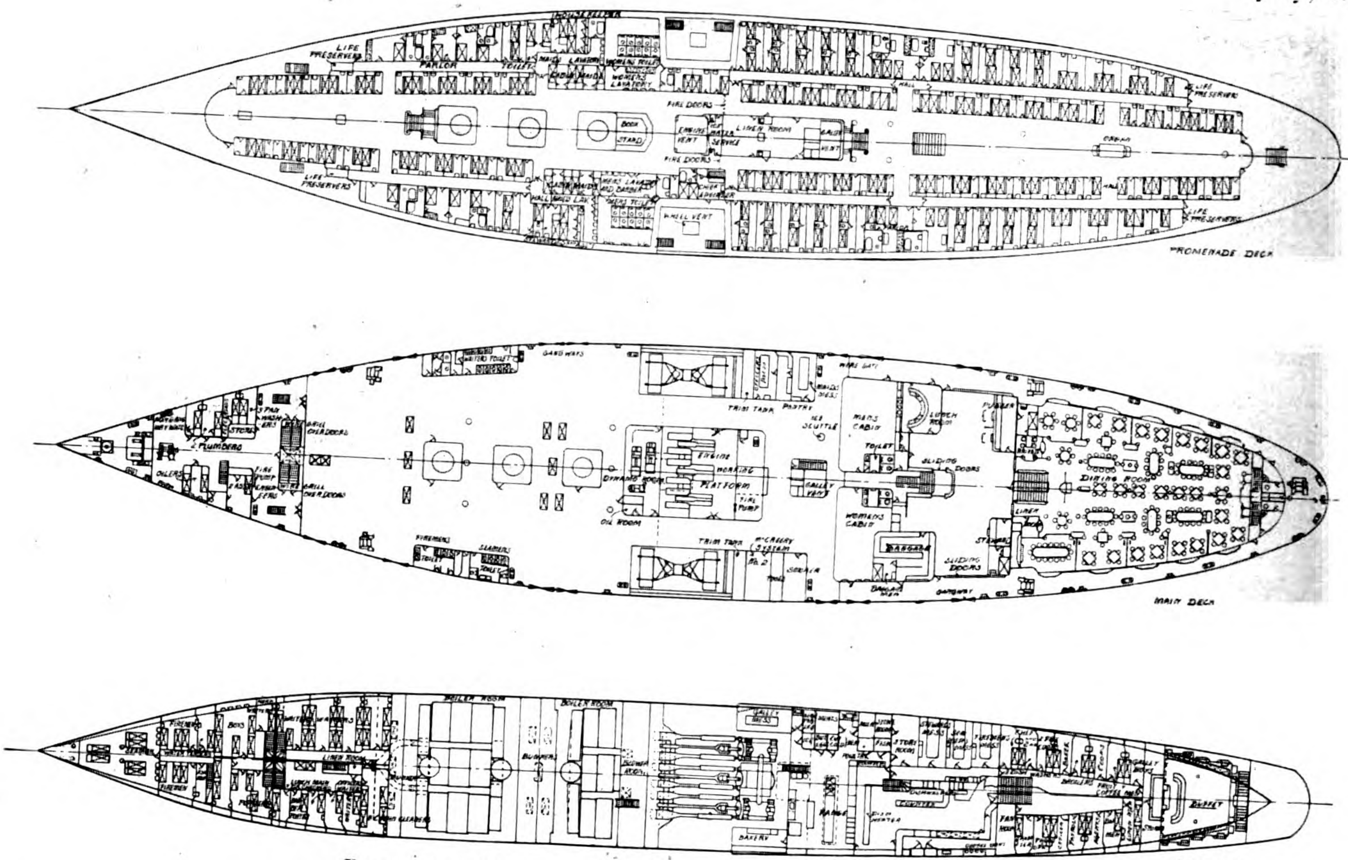
Feed Pumps.—Two 7 in x 39 in. connected to main engine.
One Blake compound simplex, 14 in., 24 in., 13 in. x 24 in.

Wheels.—30 ft. 3 in. diameter over buckets.
11 buckets, 5 ft. wide, 14 ft. 6 in. long.

Draft of Water.—Mean, 13 ft. 1½ in. Displacement, 6,370 net tons.
Endurance run from S. E. Shoals to Long Point, distance 133¼ miles. Time, 6 hours, 20 minutes.

Steam pressure, average, pounds	134.2
Receiver, average, pounds	30.17
Vacuum, port condenser, average, pounds	24.35
Vacuum, starboard condenser, pounds	24.85
Revolutions	28.25
I. H. P., H. P. cylinder	2,284.77
I. H. P., S. L. P. cylinder	2,757.37
I. H. P., P. L. P. cylinder	2,563.87
Total	7,606.01
M. E. P. reff. to one 130.1 in. L. P. cylinder, pounds	38.36
Ratio, I. H. P. ÷ grate surface	15
Ratio, heating surface ÷ I. H. P.	3.11
Temperature of sea, average, degrees	56
Temperature of hot well, average, degrees	124
Temperature of feed, average, degrees	126
Temperature of air at fan, average, degrees	95
Temperature of air in ash pit, average, degrees	252
Air pressure at blower, average, inches	4.8
Air pressure of ashpit, average, inches	.96
Speed of ship (18.27 knots), average, miles	21.05
Speed of wheels, miles	30.5
Slip of wheels, per cent	30.9

$$C = \frac{D^{2/3} \times S^3}{I.\ H.\ P.} = \frac{5,687^{2/3} \times 18.27^3}{7,606} = 255.$$



PROMENADE, MAIN AND ORLOP DECKS OF CITY OF DETROIT III

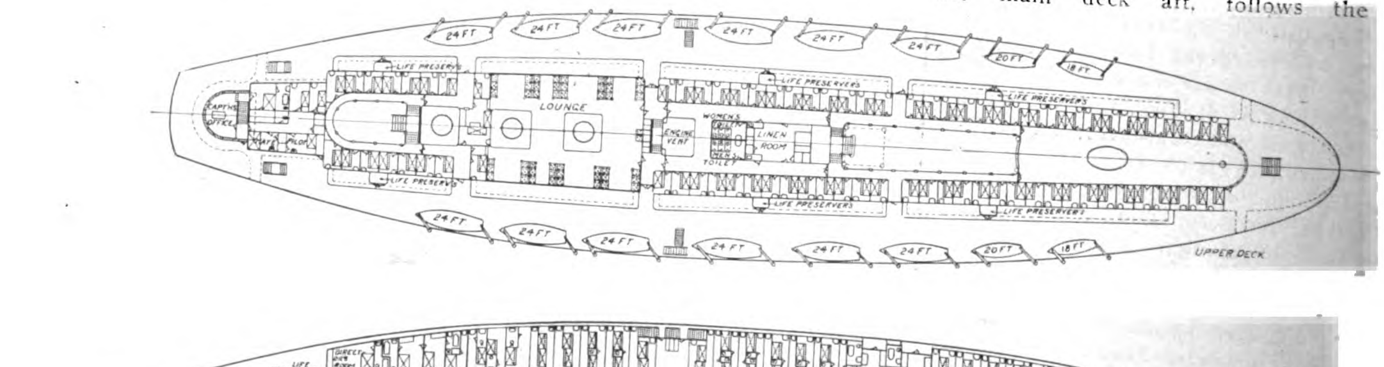
is fitted, the air being supplied by three Sirocco fans direct driven by vertical American Blower Co. engines. There are three funnels with outer casings fitted up to the level of the top deck and single above.

The ashes are discharged overboard and well clear of the ship by means of six double jet ash ejectors, two in each stokehold. The stokeholds are well ventilated and are remarkably cool even when steaming at full power.

There are 600 staterooms, 25 parlors with bath and private verandas, 50 semi-parlors with private toilets; all staterooms have telephone with shore connections when in port. The parlors are finished in poplar and hardwood and have a chiffonier, settee, thermos bottle for hot and cold water; electric fans and other conveniences built in place; each contains a large mirror and light floral paintings adorn the decorative panels. All berths in staterooms and beds in parlors are fitted with the Marshall ventilated diameters.

The lobby on the main deck is of the Doric order of architecture, finished in bold figured selected mahogany inlaid with marquetry with scagliola columns, having carved capitals with brass bases. The ceiling panels are in composition relief finished in gold. Ceiling and wall fixtures are finished in burnished antique gold, windows and doors glazed with plate and opalescent glass and the floor of interlocking rubber tiling.

The dining room, located on the main deck aft, follows the



UPPER DECK AND GALLERY DECK OF CITY OF DETROIT III

Irving R. Bacon's Mural Painting, "The Little Old Man of the Woods", on Steamer City of Detroit III

colonial in design. The wainscoting is of mahogany, ceiling panels of canvas suitably decorated. Travelers will undoubtedly appreciate the location of the dining room, as, extending the full width of the ship, it gives an unobstructed view of the sea as well as affording perfect ventilation. Ordinarily the dining rooms of side-wheelers are below the main deck where the view is confined to the splash from the wheel buckets against the portholes. In addition to the general dining room there are a number of private dining rooms finished throughout in mahogany.

The buffet, located directly beneath the dining room, is reached by a stairway finished in bold figured white oak with brass hand railings and fittings. The buffet is designed after the plan of an old wine cellar, with vaulted ceilings between the columns, the plaster being tooled to represent huge blocks of stone masonry. The floor is of tile and all woodwork of white oak, including the furnishings. Striking features of the room are paneled hogsheads with iron bands above the settees on either side of the room. The heads of the hogsheads are decorated with burnt work in colors. The electric fixtures are in the form of old hammered brass lanterns.

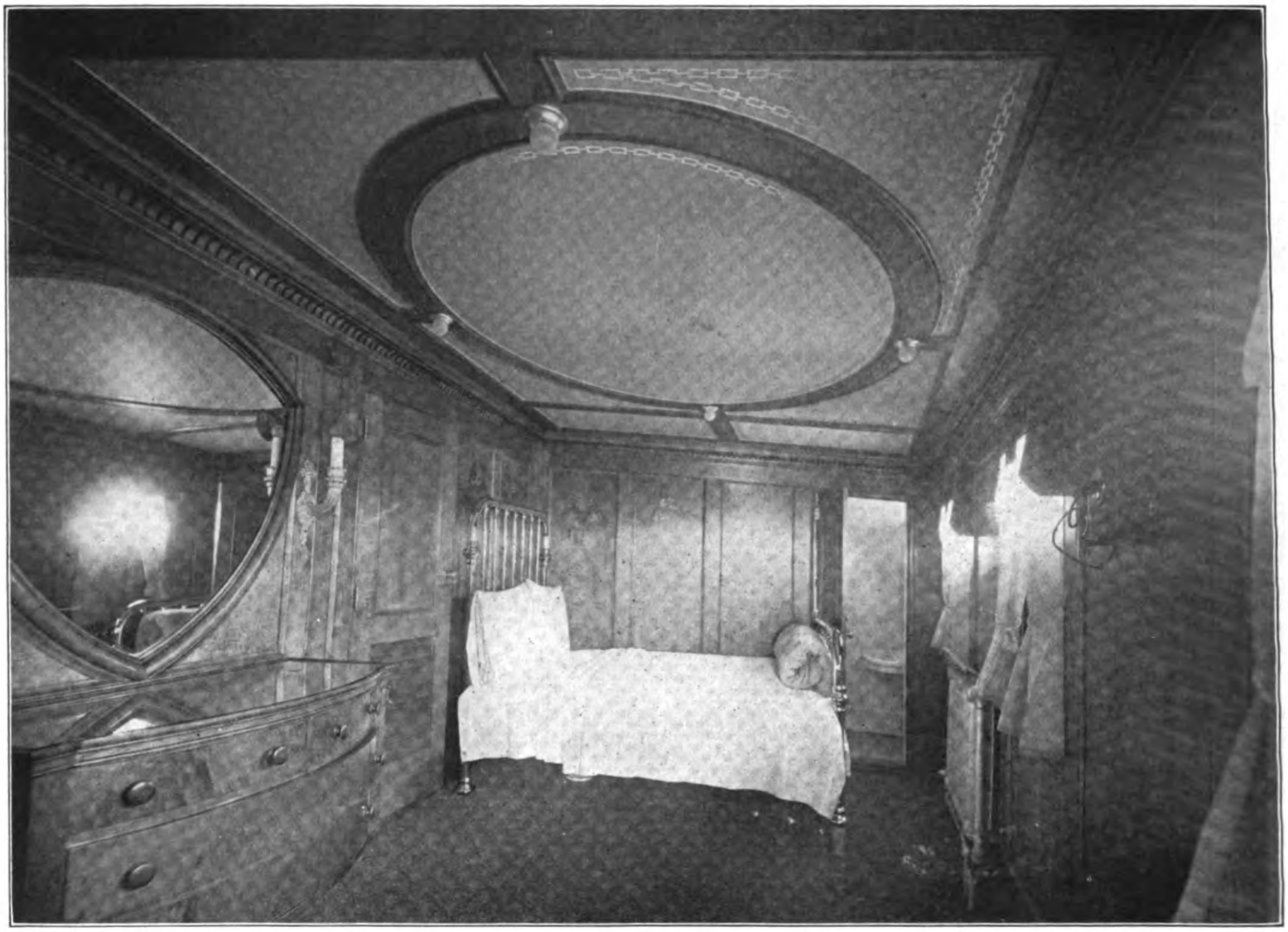
The main saloon and forward saloon on promenade deck are finished in selected mahogany with marquetry inlaid work, and the upper and gallery decks in poplar paneling. Impressive features of the decorate scheme are four large mural paintings in the ceiling of the after saloon and three in the ceiling of the saloon forward; there are two large panels at the stair landings forward and aft and three lunette panels in the dome.

The palm court is located aft on the upper deck, with pergola and bay window forward, fountain with running water and trellis screen aft; columns, cornices, flower boxes and stands lend to this place an attractiveness enhanced by the decorative scheme, and finishings that make it one of the most popular places on the ship.

The Marie Antoinette drawing-room is on the gallery deck aft, directly beneath the palm court. This is finished in poplar with paneled ceilings, ornamental cornices, columns and stringers, the panels of walls and ceilings being decorated in a light floral design of the Marie Antoinette period and the furnishings designed to harmonize.

The Gothic room on the upper deck at the stacks, is of Gothic design worked out in English oak; decorative features include carved capitals and arches, brackets, lanterns, electroliers and a mantel complete with fireplace, andirons and electric heating apparatus. Spacious settees and upholstered chairs make this a most inviting place. There are also five Tiffany stained glass panels in heraldic design. This room also contains a pipe organ and it has been reliably stated that the Mauretania does not possess any feature that surpasses the design of this room.

Reference to the illustrations will show with what care the decorative features have been worked out. It is well known that the Detroit & Cleveland has selected the frog as its



DIRECTORS' STATEROOM CITY OF DETROIT III

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emblem and Irving R. Bacon, the noted artist, has worked the harbinger of spring into a very effective mural painting under the title "The Little Old Man of the Woods."

The electrical equipment of the City of Detroit III consists of two 75 K. W. Kerr turbine-driven Northern generators working at 1,800 revolutions, 110 to 120 volts; also one 35 K. W. machine of the same working at 3,600 revolutions. The two 75 K. W. machines exhaust into a Dean jet condenser with 10 x 18 x 18 air pump.

There is a Blake vertical duplex compound ballast pump, 15 x 24 x 18, pumping from the water bottom and discharging overboard or to the trimming tanks, at will.

The sanitary pump is also a Blake duplex compound 8 x 14 x 12, supplying water to the toilet rooms; also cooling water for the main engine.

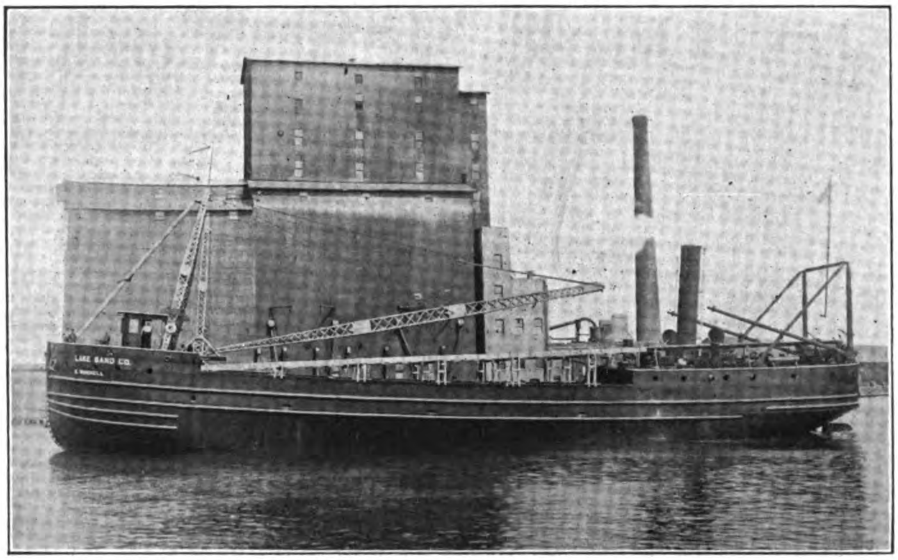
The fresh water pump is a Blake duplex, 8 x 10 x 12, drawing water for four fresh water tanks of a combined capacity of 17,000 gallons. The water for drinking purposes is all purified by an electrical apparatus furnished by the Water Purifying Machine Co., of Buffalo, N. Y.

The refrigerators and food storage spaces are cooled by an 8-ton carbonic anhydride refrigerating machine built by Kroeschell Bros., of Chicago. The feed water to the boilers is heated in a Schuette & Koerting spiral film feed heater of 162,000 lb. capacity at 200 deg. with 4 lb. back pressure.

In addition to the sprinkler pump for fire purposes, there is also a Blake Underwriter's pump, 16 x 9 x 12, also an auxiliary feed pump, Blake duplex, 14 x 7½ x 12.

The new steamer is also fitted with a Schuette recording compass which has met with such success on both lakes and ocean during the past few years.

New Sand Barge for Lake Michigan



SAND SUCKER E. GUNNELL
BUILT BY MANITOWOC SHIP BUILDING & DRY DOCK CO.

The steamer Elias Gunnell is the latest addition to the fleet of sand suckers belonging to the Lake Sand Co., of Chicago, and operated out of that port. This vessel is the third designed and built for the same owners by the Manitowoc Ship Building & Dry Dock Co., of Manitowoc, Wis., and was delivered to the owners, June 29.

The new vessel is 170 ft. long over all, 36 ft. beam and 10 ft. deep, and has a carrying capacity of 700 cu. yds. of sand in the hopper on deck.

The hopper is built as part of the hull, the regular side frames extending to top of the walls, and plated in the same way as the main hull.

There are five watertight athwartship bulkheads in the hull and a fore and aft bulkhead extending from the collision bulkhead aft to boiler room. The hull is therefore divided into nine watertight compartments, supplemented by a small watertight flat around the stern tube. Every compartment has separate bilge piping so that the water ballast may be carried in any or all the compartments.

The after deckhouse is carried out flush with the sides and end of the boat, built of steel throughout and forms an integral part of the hull. This deckhouse contains the boiler room, engine room, pump room and living quarters. There are four large comfortable crew rooms in this space besides the galley and dining room. All finished in southern pine and varnished.

The two 12-in. sand pumps are located on fan tail and over these are the derricks for handling the suction hose. These derricks are operated by a deck winch on the spar deck.

The forecastle on the main deck contains a large room for the captain and two rooms for the crew. Situated in this space also are the large hoisting and swinging engines for the operation of the unloading derrick. This derrick, which is built of steel throughout, unloads by means of a clam shell bucket.

On the forward spar deck is placed the pilot house which contains a steam stearing gear and a steam windlass to handle the two stockless anchors.

The propelling machinery consists of a 16 and 34 x 26-in. fore and aft compound engine with a jet condenser. The engine swings an 8-ft. wheel and develops 400 H. P. A bilge pump with an 8-in. suction is connected to the bilge pipe and sea cocks. The boiler is a Scotch marine type with steam drum and is 12 ft. 6 in. in diameter and 13 ft. long, carrying 160 lb. of steam. The Gunnell with a full load makes a speed of 11 miles per hour, and her regular run is between Chicago and Michigan City, Ind.

The sand suckers, of which the Gunnell is the largest, operate during a season of 10 to 11 months a year, and the winter months at the southern end of Lake Michigan are an excellent test of the seaworthy qualities and general reliability of these boats. By means of freeing ports in each pocket the vessel may be lightered of her load in case of necessity in the short space of five minutes.

The Toiler, which was brought over from Great Britain last year and which is equipped with Diesel engines, has been sold to a syndicate of which James Playfair, of Midland, H. W. Richardson, of Kingston, and H. H. Gildersleeve, of Sarnia, are principally interested. She will be operated under the management of J. Richardson & Sons, of Kingston, and will trade almost exclusively between Montreal and Port Colborne.

The New England Steamship Co., of New Haven, which is controlled by the New York, New Haven & Hartford Railroad Co., has increased its capital stock from $250,000 to $6,000,000.

Dry Dock New York Navy Yard

After Many Years of Effort and Two Adandonments of Contract Dry Dock No. 4 is Finally Completed—Description of the Great Structure

When, on May 9, 1912, the Utah, the latest and largest of our American battleships, was towed into the barely completed dry dock No. 4, at the Brooklyn navy yard, the final test of a long and in many ways novel engineering work was accomplished. The dock has been a construction problem of marked difficulty. Many novel expedients were called for and developed in the work, and it may be said that ordinary methods of construction were conspicuously absent.

As early as 1900 the necessity for increasing the sizes and modifying the type of graving dock to meet the development in the size and character of fighting vessels was realized. On June 7 of that year, congress appropriated $1,000,000 for the purpose of constructing at the New York yard a dry dock of granite and concrete. Plans were made and bids asked, but it was not until Feb. 7, 1905, that a contract was entered into by the navy department with Geo. B. Spearin for the construction of the dock. As contracted for, the dock was to be 554 ft. long. The maximum ship provided for by the dock was 506 ft. long and 91 ft. beam. The method adopted was to make an open excavation within a cofferdam of steel sheet piling, and construct the entire dock in this open cut. The sheet piling was driven in, however, by the surrounding soil, and having no firm foundation, offered no effective resistance. The movement finally produced marked settlement in surrounding territory, damaging several nearby buildings and breaking a large Brooklyn city sewer which traversed the site of the dock, flooding the work. Added to this, the quicksand located a short distance below the surface, was impossible to handle, and Spearin finally abandoned the work.

On April 14, 1908, the contract was re-let to the Williams Engineering Co. The size of the dock under the contract was increased to 620 ft. over all, which provided for a ship 525 ft. long. The Williams company practically repeated history; although they added somewhat to the total amount of excavation and actually succeeded in placing about 10,000 yards of concrete in sheeted trenches, the over-

FIG. 2.—SHOWING THE CAISSON GATE FLOATING INTO POSITION BEHIND THE UTAH

hang still closed in and the sands boiled. The work was again abandoned and the contract cancelled.

An unusual step was now taken by the navy department. Five construction companies of the requisite financial strength were invited to bid for the completion of the dock. The Holbrook, Cabot & Rollins Corporation, of Boston, was the low bidder, at $1,-389,000, and contract was made with them on Nov. 13, 1909. Almost coincident with this, Civil Engineer Frederic R. Harris, United States navy, was detailed by the department to take charge of the work, and as soon as he had made his preliminary examination of the site, reported that it was not feasible to build the dock by the use of ordinary methods. A new type of construction was advocated and finally adopted by which the foundation work would be prosecuted by the use of pneumatic caissons.

Preliminary Work.

An exhaustive set of core borings were driven at intervals over the site of the work, and caisson sinking began. Bed rock was found at a practicable level near the head of the dock, but at the entrance and for about half the length, it was found that reliance would have to be placed on the typical boulder and sand hardpan encountered.

The size of the dock was again increased to these final dimensions: 726 ft. long, over all; 139 ft. 6 in. wide at coping; 110 ft. wide at a point 35 ft. below M. H. W.; and 30 ft. over sill at mean high tide.

The dimensions as given above will take any ship capable of passing the locks of the Panama canal, not over 690 ft. long. Finding that the original plan of surrounding the site with a pneumatic caisson cut-off wall, within which a dock of the original type was to be built in the impounded material, would not be possible, owing to the impracticability of reaching rock with compressed air work at the entrance end, this design was of necessity abandoned. It had been proposed to build a heavy or gravity type structure resting on piles driven at regular intervals and close together over the entire area.

The inverted arch floor of concrete was to be 17 ft. thick, to resist the hydrostatic thrust when the dock was empty, and was so designed as to transmit this thrust to the side walls, of massive construction, whose additional weight was to make the whole structure stable, while the weight of the structure itself and of the supported ship was to be taken by the piles.

The construction, as outlined above, was found to be impossible without penetrating some distance into the unstable quicksand which underlaid the entire area. This was a fine sand, saturated with water, and when so saturated, flowing almost as freely as water itself. The removal of all top soil over the area would release this unstable material and its removal would become practically an impossibility.

The attempt to do just this thing was, in a large measure, responsible for the early failures.

Final Design.

In this dilemma, new methods were devised and it was fially decided to sink a continuous wall 5 ft. in thickness around the entire dock, either to rock or hardpan, and to finally incorporate this wall with the superstructure in such a way that it should become practically monolithic construction. Caissons 36 ft. long and 5 ft. wide were sunk end to end, in such a position as to be in line with the center of gravity of the dock wall above. Each end of these caissons was provided with a semi-circular recess, and these, abutting, were finally sealed with a solid concrete key, placed under pneumatic pressure. The structure as now designed contemplated a reinforced concrete floor slab, approximately 8 ft. thick. This was supported along the center and on two lines parallel to the center line by reinforced concrete piers, 7 ft. square. These piers were sunk in caisson to a point determined by the material encountered, till they reached a reliable bearing below the quicksand, when they were flared by poling boards to a minimum of 11 ft. square. The piers were located in ranks 20 ft. center to center longitudinally, and the side lines were each 24 ft. from the center line. This provided for the weight of a ship in dock being supported as a direct thrust on these piers, each of which provided 121 sq. ft. of bearing area on the firm stratum in which they were anchored. They further served the purpose of providing resistance against uplift from the hydrostatic pressure, being in effect immense mushroom anchors, the center line providing a resistance of 500 tons each and the side piers, which were not sunk to as great a depth, took care of 400 tons per pier.

Reinforcement.

The floor reinforcement was placed in such a way as to make the slab capable of beam action in both directions. This was necessitated by the fact that the three governing conditions of greatest stress, viz., with the dock empty and water pressure acting upward; with the dock flooded, and the weight of the structure and contained water acting downward; and with the dock pumped out with a ship in it, producing a heavy concentration on the supporting piers and floor; demand that a complete reversal of stress shall be provided for. It was necessary to provide for a maximum possible thrust upward on the bottom at mean high tide of 2,900 lb. per square foot, in addition to the ship loads given above acting downward and the weight of the structure itself; and 3.8 sq. in. of twisted steel rods were provided for each running foot of the dock floor, both top and bottom.

The surrounding caisson wall was reinforced by 60-lb. steel rails, placed vertically, on 2-ft. centers outside and 8-ft. centers inside of the wall. These rails projected so as to furnish mechanical bond with the superstructure at the point when the floor joins the sidewalls, 1-in. square twisted rods were placed at an angle of 45 deg., projecting toward the center line, 1 ft. center to center. Alternate rods were bent to a horizontal position so as to lie in the plane of the floor; the balance projected into the bulk of the side wall. Above the floor level the face of these walls was provided with short rods, 5 ft. by 4 ft. center to center, to provide bond with the bulk of the superstructure wall. The piers supporting the floor were reinforced vertically by 60-lb. rails and 3-in. diameter bolts which were allowed to project to interlock with the steel in the floor.

Arch Head.

The head of the dock is a semicircle of approximately 70 ft. radius. The caissons which enclose this space are made segmental in shape, and are 7 ft. thick, so that a horizontal arch of approximately 4 ft. thickness lies entirely within their mass. These features will be easily identified by reference to Fig. 1. The cut-off feature of the foundation wall was completed by two lines of caissons sunk across the mouth of the dock. These were 40 ft. apart, and so constructed that their vertical continuation formed a cofferdam, within which the gate sills, 25 ft. apart, and the connective entrance floor and sidewalls were laid in the open cut. This open working was braced in both directions by timber framing at right angles, successive tiers being placed as the excavation proceeded, the removal of excavated

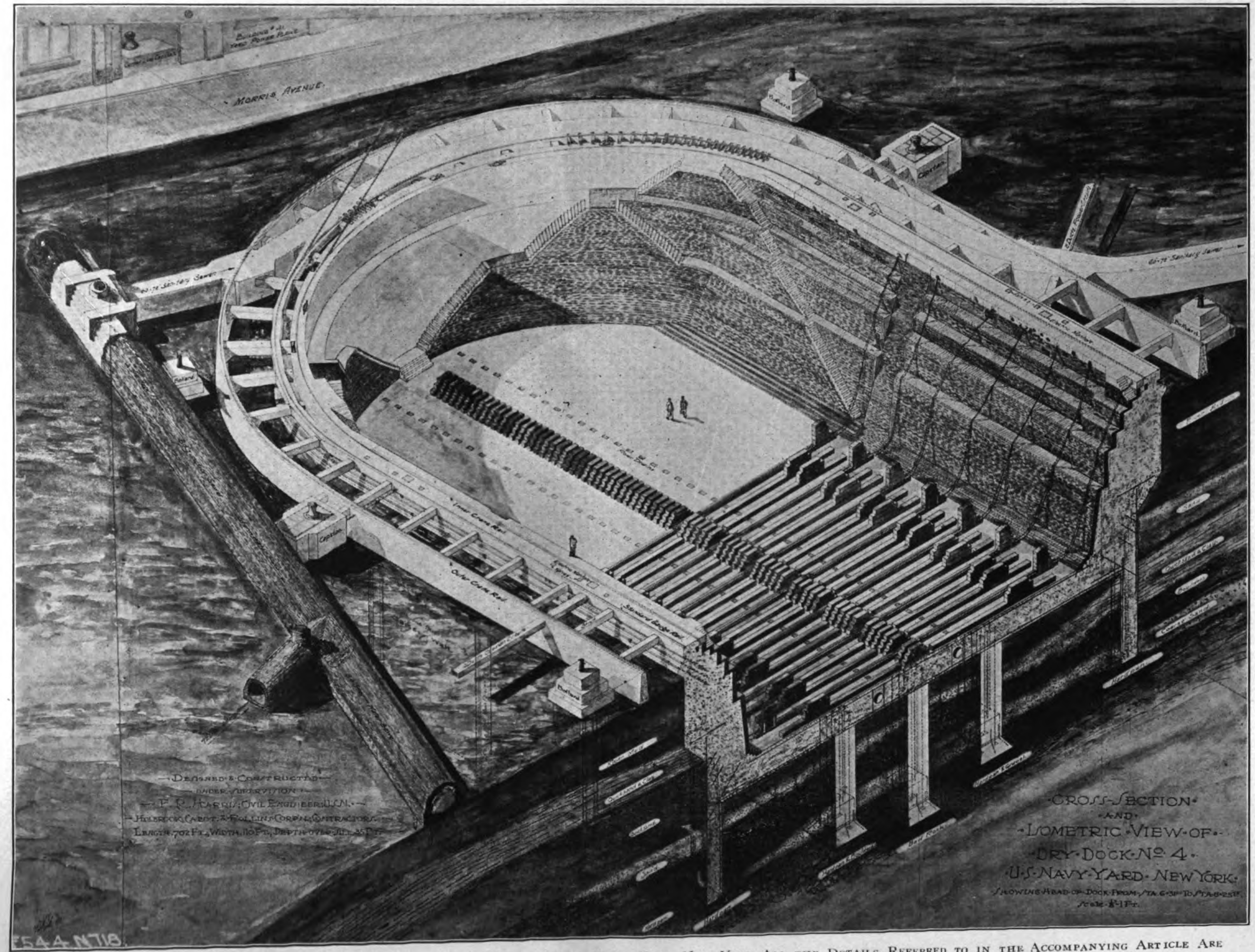


FIG. 1—CROSS-SECTION AND ISOMETRIC VIEW OF DRY DOCK NO. 4, UNITED STATES NAVY YARD, NEW YORK. ALL THE DETAILS REFERRED TO IN THE ACCOMPANYING ARTICLE ARE SHOWN IN THIS FIGURE, EXCEPT THOSE RELATING TO CAISSON GATE AND PUMP WELL

spoil and the introduction of structural material being accomplished through the square openings left in the bracing. When the entrance was completed, this bracing was removed and inclined braces resting on the granite sills held the face of the cofferdam against external pressure.

Owing to obstruction from the steel sheet piling left by the early contractors, it was necessary to make a digression in the line of the cut-off wall for a portion of the distance on both sides to permit this piling to be removed in the open interior excavation, made after the caissons were in place. Much of this had to be cut with the oxyacetylene torch, as it was impossible to pull it.

Floor Construction

When the cut-off wall and interior piers were all in position, the work of placing the floor began. The operation consisted of excavating a strip to subgrade from wall to wall, and placing in position struts made of four 12 by 12-in. timbers connected by lattice bracing, and bolted so as to act as one piece. Inequalities in length were taken up by short timber balks and paired wedges. These trusses were spaced 20 ft. center to center, and second, and in some instances, third tiers were placed and keyed, and longitudinal and sway bracing provided. The excavation between two adjacent struts was then carried to sub-grade and a strip of floor laid and finished. A space on each side was left undisturbed and other strips laid. When sufficiently set, the bracing was removed and the remaining segments of floor placed in position between the strip already in place. As the work progressed it was found possible to open wider spaces, and one piece of floor 45 ft. long, involving 1,700 cu. yds. of concrete, was put in place in 26 hours.

Holes in the floor provided for the pumping of infiltered water, thus relieving pressure on the floor until the side walls had been placed in sufficient mass to provide the necessary stability, when they were sealed, connections being left for pressure gages, by means of which it was found that the floor was successfully resisting the full hydrostatic thrust estimated on.

Dock Lining, Etc.

With the exception of the coping, abutment and gate sills, which are of New England granite, the facing of the dock is of hard burned vitrified brick, except at the head, above the stair line, where the face is concrete. The 14 stairways are of concrete with Wainwright nosings. Ten material slides are provided, 6 ft. wide, each side of each slide being an expansion joint.

Floating Caisson Gate

The gate for this novel structure is also a novelty in the United States, being of the hydrometer type which has recently been proved successful in European docks.

The pumping equipment is located in a well near the mouth of the dock, being an irregular pentagon abutting on the dock wall, built in caissons, similar to the cut-off wall and keyed to them. It is approximately 28 ft. wide and 50 ft. long. The pumping equipment consists of three vertical shaft, one-stage volute pumps, driven by 48 pole, three-phase, 60-cycle, 2,300-volt induction motors, with 54-in. diameter intakes and 48-in. diameter discharge ends. These pumps have a rated minimum capacity of 8,800 cu. ft. per minute under the maximum head, and are capable of emptying the dock in one hour and 20 minutes continuous run. Two 15-in. pumps of similar type are provided to handle the water below the vacuum level of the large pumps and to handle drainage. Both sets of pumps are provided with motor-driven stop valves, and necessary checks. The floor of the dock is provided with four openings, 16 ft. by 6 ft., which connect directly by tunnels 6 ft. square to a forebay in the mass of the dock wall. The discharge is into a culvert built into the wall, 10 ft. wide by 16 ft. high, and opening to free water outside the gate. The floor is also traversed for its full length by two drains, 3 ft. diameter, with intakes 4 ft. apart, to facilitate the removal of water impounded between the blocking on the floor, and to handle drainage when a ship is in dock. These connect with the openings into the forebay.

Supply Lines

Electrical service is supplied through conduits laid in the side walls, with numerous manholes, and outlets on the face of the dock above high water. Submerged outlets with watertight connection boxes are also provided at two points below water level.

Salt water, fresh water and compressed air are supplied by 6-in. diameter mains encircling the structure with branches to the face of the dock wall.

Three capstans are provided on each side, and one on the center line at the head of the dock. Nineteen bollards, of obsolete guns set in concrete blocks, are placed at regular intervals along the sides.

A crane track, 18 ft. gage, encircles the dock, the inner rail resting on the coping and the outer rail on a continuous concrete girder 8 ft. deep, supported on piles, providing a runway for the 40-ton cranes used in connection with the dock. Another rail, at standard gage from the inside crane rail, provides for small locomotive cranes and other standard gage rolling stock. A standard gage track also crosses the caisson gate, connection being made at either end to the yard railroad tracks. Figure 1 shows these details clearly.

The plan, as outlined by Mr. Harris and carried to successful completion by Fred Holbrook, who had immediate charge of the work for his firm, has been successful in all respects, and the completed dock was emptied for a ship on May 9, 1912, only two years and a half after work began.

In the caisson work, 32,000 cu. yds. of concrete was placed. The remaining work required approximately 60,000 cu. yds.; 2,000 tons of reinforcing steel were used. The total cost is about $3,000,000. Taking into consideration the fact that the work has been completed in the remarkably short time above mentioned, including over a year in caisson work alone, the interference from obstructions left by former contractors, the novel conditions to be met and provided for, often on the spur of the moment, and the unusual co-operation between engineers and contractors, it is safe to say that a record for speed and economy in work of this character has been successfully established; and that all concerned have a legitimate source of pride in its successful conclusion.

Trial Trip of Battleship Arkansas

The official figures of the recent builders' trial trip of the battleship Arkansas have just been compiled by the trial board. The performance exceeds contract requirements. The fastest mile run on the standardization trial was 21.493; average of five high-speed runs, 21.153; average of four-hour run, 21.51; average of two-hour run, 20.989; maximum horsepower developed, 29,271.

The Western Maryland Railroad Co. has awarded to the Skinner Shipbuilding & Dry Dock Co., Baltimore, a contract to build two car floats for the company's service in Baltimore harbor. They are to be double-tracked, 230 ft. long, 33 ft. beam and 8 ft. deep.

Life Saving Equipment

The Steamboat Inspection Service Has Amended Its Rules Regarding Character of Equipment to be Carried

Since the Titanic disaster the general subject of safe-guarding life at sea has been given serious attention by both departments of the United States government. The United States, as is well known, has gone exhaustively into the subject and bills have been prepared embodying the results of the inquiry. Meanwhile the Steamboat Inspction Service has amended its rules regarding the character of life-saving equipment and has adopted the following regulations, which became effective on July 1, 1912, as follows:

For the purpose of apportioning lifeboat and life raft equipment, steam vessels under the jurisdiction of the steamboat inspection service now in service or under construction shall be classified in accordance with the service in which they are engaged, the various classifications to be designated as follows:

Ocean Steamers.

Under this designation shall be included all steamers whose routes extend 20 nautical miles or more off shore.

Coastwise Steamers.

Under this designation shall be included all steamers whose routes throughout their entire length are restricted to less than 20 nautical miles off shore.

Lake, Bay and Sound Steamers.

Under this designation shall be included all steamers navigating the northern or northwestern lakes, or the bays and sounds tributary to the waters of the Atlantic or Pacific oceans or the Gulf of Mexico.

In this class shall also be included steamers navigating the waters of the Atlantic or Pacific oceans or the Gulf of Mexico whose routes are restricted to 1 nautical mile or less off shore.

River Steamers.

Under this designation shall be included all steamers whose navigation is restricted to rivers exclusively.

Lifeboats Required.

All steamers other than steamers carrying passengers, except as otherwise hereinafter provided for, must be equipped with sufficient lifeboat or life raft capacity to accommodate at one time all persons on board. One-half of such equipment may be in approved life rafts or approved collapsible lifeboats.

Ocean steamers carrying passengers must be equipped with sufficient lifeboat and life raft capacity to accommodate at one time all persons on board, including passengers and crew. One-half of such lifeboat and life raft equipment may be in approved life rafts or approved collapsible lifeboats.

Coastwise steamers carrying passengers must be equipped with sufficient lifeboat and life raft capacity to accommodate at one time all persons on board, including passengers and crew; provided, however, that such steamers navigating during the interval between the 15th day of May to the 15th day of September in any one year, both dates inclusive, will be required to be equipped with only such lifeboat and life raft capacity as will be sufficient to accommodate at one time at least 60 per cent of all persons on board, including passengers and crew; two-thirds of such required lifeboat and life raft equipment throughout the year may be in approved life rafts or approved collapsible lifeboats.

Lake, bay and sound steamers carrying passengers must be equipped with sufficient lifeboat and life raft capacity to accommodate at one time all persons on board, including passengers and crew; provided, however, that such steamers navigating during the interval from May 15 to September 15, in any one year, both dates inclusive, will be required to be equipped with only such lifeboat and life raft capacity as will be sufficient to accommodate at one time at least 30 per cent of all persons on board, including passengers and crew; provided further, that such steamers navigating routes lying at all points within a distance of 5 miles from land, or over waters whose depth is not sufficient to entirely submerge the vessel in case of disaster, will, during the interval from May 15 to September 15, in any one year, both dates inclusive, be required to be equipped with only such lifeboat and life raft capacity as will be sufficient to accommodate at one time at least 10 per cent of all persons on board, including passengers and crew. Three-fourths of the lifeboat and life raft equipment required on lake, bay and sound steamers may be in approved life rafts or approved collapsible lifeboats.

River steamers carrying passengers must be equipped with sufficient lifeboat and life raft capacity to accommodate at one time at least 10 per cent of all persons on board, including passengers and crew. Three-fourths of such lifeboat and life raft equipment may be in approved life rafts or approved collapsible lifeboats.

Steamers of less than 150 gross tons while engaged exclusively in harbor towing may substitute one or more life rafts for the lifeboats required, when the lifeboats interfere with the practical operation of the steamer and such substitution may be made with safety, it being understood that when such vessel engages in service other than harbor towing she must be equipped with lifeboats as required by the rules.

Steamers of 50 gross tons and upward carrying passengers must have one working boat in addition to the lifeboats required. The cubical capacity of the working boat on steamers navigating the Red River of the North, rivers whose waters flow into the Gulf of Mexico, Yukon river and other similar rivers, the bars and channels of which are liable to sudden change, shall be included in the cubical capacity of lifeboats required.

Steamers that are used exclusively as fire boats and connected or belonging to a regularly organized fire department shall be required to carry only such boats or rafts as in the judgment of the local inspectors or supervising inspector may be necessary to carry the crew.

Stern-wheel towboats engaged exclusively in the business of towing shall not be required to carry lifeboats, but shall be required to carry such boats only, as in the judgment of the local inspectors will, by their number, capacity, character and equipment, fully provide for the safety of the crew of the vessel.

When a steam or motor launch is accepted as a lifeboat the space required for the engine, boiler, motor or fuel must not be included in the cubical capacity of the boat.

Vessels engaged exclusively in the business of seine fishing or wrecking may substitute a wooden surfboat or wooden seine boat for the lifeboat.

Watertight Subdivision of Liners

The Fiction of the "Unsinkable Ship" Has Been Shattered—Some Suggested Reforms in Ship Construction That May Come Out of the Titanic Disaster—Compared With Battleships the Present Design of Liners Appears Unsafe—The Elimination of the Watertight Door in Bulkheads

COMMODORE WILLIAM HOVGAARD

The fiction of the "unsinkable" ship has been shattered. It is well that this should be so, for it appears that on the strength of this fiction unwarranted risks have been taken one way and the other. Of the good things likely to come out of the terrible Titanic disaster, this disillusionment is, perhaps, not the least important. The risks connected with the navigation of liners will henceforth be estimated at their true value, and proper measures will be taken to meet them.

The reforms in point of navigation and boat equipment are obvious, and are already under way. The reforms in the construction of the ships are not so clearly recognizable, and admit of alternative selections. These reforms cannot meet the requirements in a complete measure, for a ship cannot be made unsinkable. The term "unsinkable ship" was a misnomer, which simply meant, if it meant anything at all, that the ships so-called were less sinkable than other ships. In other words, the "unsinkability" was a relative term, used as a soothing application by shipping men and by the public against uneasiness and doubts as to the risks that were taken.

The one man in the United States who has given more attention to watertight subdivision of vessels than anyone else is William Hovgaard, professor of naval design and construction at the Massachusetts Institute of Technology, and it is quite natural that he should have had something to say regarding the Titanic disaster. He has discussed the subject thoroughly in Engineering, of London, and has reached some important conclusions which will undoubtedly be considered in future design of liners.

Liner Design Seems Unsafe

Compared with battleships, the liner, as ordinarily designed, appears to the naval constructor positively unsafe. It is admitted that battleships are subject to greater dangers than liners, and that it would be impossible, from a commercial point of view, to endow liners with the same water-tight sub-division as a modern battleship. The discrepancy is, however, far greater than justified by these considerations, when the liners attain the size and cost of ships like the Titanic, and, in particular, when several thousand human lives depend on the safety of the ship.

The Titanic had 16 large water-tight compartments, separated by transverse bulkheads. A double bottom, divided in about 60 smaller compartments, was fitted along the greater part of the length, but transversely it extended only to the turn of the bilges. All the large compartments were, therefore, along the sides of the ship separated from the sea only by one wall of plating, the outer shell. It is in this region that damage by collision and by ice is likely to occur. Any such damage, even a very light case of puncture or tearing, would cause a large compartment to be flooded, and would put the ship in a serious situation (see Fig. 1).

By way of illustration, there may be mentioned the case of a liner, of 10,000 tons, which was run into by another steamer a couple of years ago outside the New York harbor. The ship was constructed as other liners, the double bottom extending to the turn of the bilges, as in the Titanic. The collision took place in way of the engine room. The outer plating was not even broken through, but a sea-valve fitted on the side above the double bottom was damaged. Through this valve the engine room was soon completely flooded, the ship had to be beached, and the repairs occupied two months. Had the double bottom extended up the sides, with a sea chest for the valve, the engine room would probably not have been flooded.

Sub-division in Battleships

In a modern battleship the shell is doubled everywhere on the immersed portion of the hull up to the armor shelf. Above the armor shelf, up to several feet above the water line, a cofferdam or some other form of cellular sub-division is fitted, making a total of more than a hundred water-tight compartments between the outer and inner shells. At the extreme ends of the ship cells or trimming tanks take the place of the double bottom. Inside the inner skin so formed, the hold of a battleship is now, moreover, subdivided in about 300 water-tight compartments, of which only the boiler and engine rooms are of large size. Abreast of these large compartments are fitted one, and generally two, longitudinal side bulkheads. Thus most of the large compartments in a battleship are separated from the sea by four vertical walls (see Fig. 2).

All the water-tight bulkheads in the Titanic, except two, or perhaps

three, bulkheads in the bow and one right aft were pierced by water-tight doors on a low level. If these doors were not closed, the water could flood the ship practically from one end to the other. The doors were placed just above the inner bottom, as low as possible, and therefore in the most dangerous position. Water-tight doors form points of structural weakness in the bulkheads. There can never be absolute certainty of their being closed in the critical moment; the personnel may fail to act, the closing mechanism may be out of order, the bulkheads may be warped, or the door opening may be blocked. Water-tight doors are, therefore, always a source of danger, and the more so the lower they are placed. Modern battleships are divided into a similar number of large sections by the main transverse water-tight bulkheads, but these have no doors on a low level. Each section forms an almost independent unit, having its own drainage, ventilation, and access along vertical lines. In order to pass from one section to another it is necessary to go up to a deck above or near the water line, through a door on that level, and then down again.

Fig.1. "TITANIC."

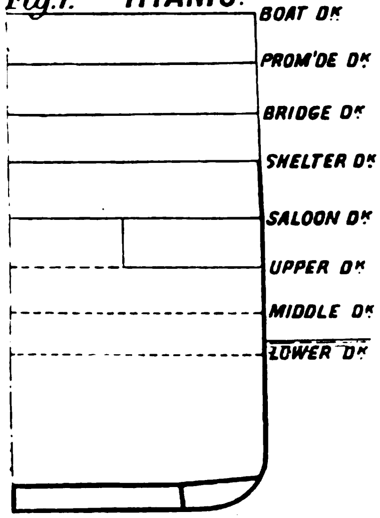


Fig. 2. MODERN BATTLESHIP

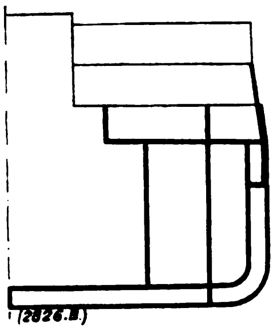


Fig.3.

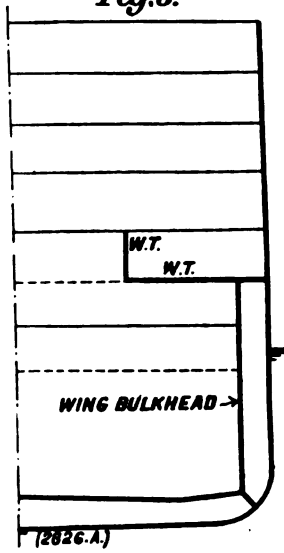
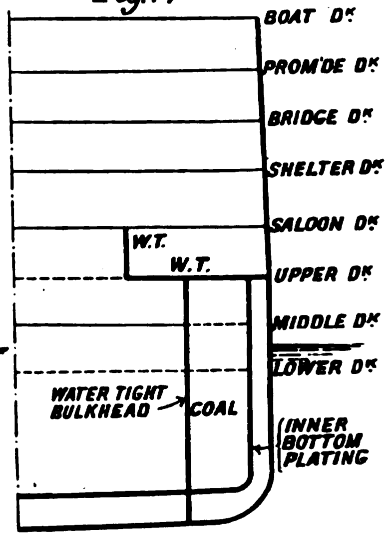


Fig.4.



Seams and Butts Single-Riveted

The seams and butts of the Titanic were single-riveted. This construction, which may be of sufficient strength in ships of moderate size, provided the bulkhead plating is very minutely and rigidly supported, is hardly adequate in large liners, especially as the bulkheads near the ends of such long vessels may become exposed to enormous heads of water in serious cases of bilging, and then leakage, and even tearing, of the seams and butts is liable to occur. In the case of the Republic above referred to it appears that the engine room was flooded to a considerable height above the inner bottom. By leakage of the aft engine room bulkhead the water penetrated into the aft portion of the ship. The ship gradually settled by the stern, until finally, when she was taken in tow, several crashes were heard below, probably due to the carrying away of the bulkheads, whereupon the ship went down. Thus the loss of the Republic was probably primarily due to a weakness of the single-riveted seams and butts of the bulkheads.

When a large ship runs aground on a rocky bottom with anything but very slow speed, the pressures acting at the points of contact will practically always be greater than the plating of the outer shell is able to stand. Puncture, breaking and tearing will take place, and a shearing action, somewhat like that of a can-opener, will commence and will be continued until the energy of the ship's motion is exhausted. Similar conditions will exist by collision with a large iceberg or ice-floe, which is generally many millions of tons in weight; only the action will here ordinarily be along the side instead of under the bottom of the ship. While the total pressure, and generally also the intensity of the pressure, created initially, will be roughly proportional to the momentum of the ship, the depth and extent of the damage will be essentially dependent on the kinetic energy. For instance, the momentum of a ship of 60,000 tons displacement, going at 21 knots speed, is nine times as great as that of a ship of 10,000 tons going at 14 knots, and the kinetic energy is nearly 14 times as great. The plating of the former ship is barely twice as thick as that of the latter. It is clear, therefore, that even if we allow for a somewhat larger area of contact and stronger framing for the larger ship, the damage will go far deeper and will be more extensive in the larger ship than in the smaller. Hence the former is much less capable of resisting such action than the latter.

Shell Plating a Vulnerable Membrane

Relative to the enormous forces that may come into play by grounding, by collision with icebergs, and even by collision with other ships, the shell-plating of a large ship can only be considered as a thin vulnerable membrane, stretched over a more or less rigid framework. The action in such cases is not that of an impulse or shock, but resembles much more a relatively slow, irresistable punching, existing locally, and generally not straining the ship as a whole. This explains why collisions in large ships are generally not strongly felt except in the immediate neighborhood of the point of impact. It follows from these considerations that the larger ship, being more vulnerable than the smaller, should be relatively better subdivided, and it is particularly important that the outer shell should be doubled—in other words, that there should be an outer and an inner shell—over the entire immersed surface. Fortunately, it is possible to sub-divide a large ship much more minutely than a smaller ship without sacrificing an undue percentage of the useful internal space. It is, in fact, one of the intrinsic advantages of the large ship that, without inconvenience to the service, it may be subdivided to such an extent as to render it much safer than the smaller ship, even allowing for the greater vulnerability of the outer

shell.

The structural features here proposed in the construction and subdivision of liners are such as are thought suitable for ships of the size and type of the Titanic. The same features are applicable in principle also to liners of smaller as well as of larger size, with obvious modifications.

Structural Features Proposed

1. There should be a complete double shell extending from end to end of the ship, not only in the bottom of the ship, but also up the sides to a deck placed at least one deck height above the waterline amidships. In the Titanic the deck fulfilling this condition is the upper deck, which in that vessel was about one and one-half deck height above the waterline amidships. With the sheer usual in such vessels, this rule implies that at the ends of the ship the double bottom will be carried to about two deck heights above the water line. In the boiler and engine rooms and in the larger hold spaces the doubling should consist of a longitudinal wing bulkhead, placed some 4 ft. to 6 ft. inside the outer shell on each side of the ship. Such wing bulkheads can be made more independent of the outer shell than an inner bottom, and are, therefore, less likely to be strained in case of collision. They should be stiffened independently by stiffeners and by transverse bulkheads, subdividing the wing spaces into numerous compartments. These wing compartments should be treated as ordinary double-bottom compartments, accessible only through manholes.

Forward and aft of the large compartments the doubling should consist of an ordinary double-bottom construction, and the same may be used also abreast of the large compartments, where longitudinal bunker bulkheads are fitted along the sides, as in the Lusitania. Such bulkheads are indeed highly to be recommended, provided they are of sufficient strength to resist the water pressures and that they are provided with water-tight doors. The bunker bulkheads of the Lusitania undoubtedly fulfill these conditions, but no double bottom is fitted on the sides. The combination of a double bottom with a side bulkhead, even if not used in the boiler rooms, should in any case be fitted in the engine room, on account of the large size and importance of this compartment.

A wing bulkhead, as shown in Fig. 3, may be considered to give the minimum desirable degree of safety to a ship of the size of the Titanic. The combination of bunker bulkheads and double bottom, as shown in Fig. 4, gives a reasonable, by no means extravagant, measure of safety.

Doubling of the bottom, as here proposed, will not, of course, prevent flooding of the large compartments in all cases. The inner bottom or wing bulkhead may be strained or broken through, but even in such case it may often help to limit the flooding, for the damage may not everywhere be so deep-going.

Watertight Deck

2. The deck at which the double bottom and the wing bulkheads stop, generally the second deck above the water line (in the Titanic the upper deck), should be made watertight the entire length of the ship. The hatches in this deck, which must always be left open, such as funnel and engine room hatches and certain companionways, should be provided with watertight trunks carried up to at least one deck height above the watertight deck. Other hatches in this deck should be provided with watertight covers.

3. Let us assume that the main traverse bulkheads are distributed essentially as in the Titanic, dividing the ship in a number of large sections. In the Titanic each of these sections forms, in point of watertightness, but one compartment. It is now proposed that the sections in the bow region—in other words, to about one-sixth of the length of the ship from the bow—shall be sub-divided in a number of smaller watertight compartments. In fact, every opportunity of subdivision which offers itself in this region of the ship should be utilized. The partition bulkheads and decks, necessitated by the internal arrangements, should be made watertight, and the requisite watertight doors and hatches should be fitted. The aft end of the ship should be subdivided on similar principles as the forward end, although, may be, less extensively. The main watertight bulkheads should everywhere be carried at least to the height of the watertight deck. Near the ends of the ship the height of the bulkheads should be increased to one or two deck heights above the watertight deck, the highest bulkheads being found nearest the stem and stern. The collision bulkheads should extend to three deck heights above the watertight deck.

4. No watertight doors should be fitted below the watertight deck in the main transverse bulkheads in the bow region. In the remaining part of the ship the watertight doors should, wherever possible, be placed at a good height above the inner bottom, preferably near the water line.

5. The main bulkheads should have double-riveted seams and butts.

It is believed that by modifications such as here proposed in design and construction, to be more highly developed in case of a further increase in size, the large liners may be made as safe, and even safer, than the smaller liners. The Titanic disaster does, therefore, not show that a return to smaller ships ought to take place. This, in fact, would be a retrograde move. The larger ships offer so many and great intrinsic advantages that size ought to be, and must be, still further increased in the future.

The Titanic disaster does show, on the other hand, that the rules of the classification societies and of the board of trade should be radically changed, so as to embody a more elaborate watertight sub-division than hitherto used in this class of vessels. The additional first cost and running expenses incurred by such improvements in construction will ultimately be paid for in the form of higher passage money, or they may be met by a reasonable reduction in the claims to speed and luxury. The option between these alternatives may be left to the public, but in no case should the safety of the ship be compromised in order to meet the demands for extreme speed and luxury.

Diesel-Engined Vessel Indian

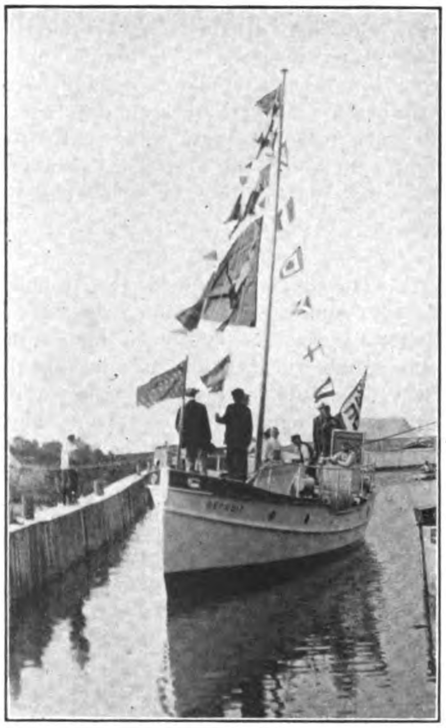
The Diesel-engined vessel which is being built by the Clyde Ship Building & Engineering Co., Port Glasgow, Scotland, for Norcross & Co., of Toronto, will be named Indian. She is of Canadian canal size, being 257 ft. in length, 42½ ft. in breadth and 26½ ft. in depth. Her engine will be of the Carels-Diesel type of 1,100 H. P., driving a single screw. The engine is of the four-cylinder two-cycle type with a bore of 18 in. and a stroke of 36 in. The cooling water is circulated by a pump driven by a steam engine, the steam for which is obtained from a donkey boiler furnished with oil fuel and which also operates the other auxiliary appliances throughout the ship. Sufficient fuel will be carried to keep the main engine running for 25 days. It is understood that the builders have guaranteed the vessel for six months of regular service.

Detroit—A Transatlantic Gasoliner

The launching of the little gasoline power boat Detroit, designed and built for the express purpose of crossing the Atlantic ocean under her own power, took place at the yacht yard of the Matthews Boat Co. at Port Clinton, O., the afternoon of June 25. Appropriate ceremonies connected with the christening of the tiny ship preceded the immersion, including a speech by Capt. Thomas Fleming Day, of New York, who will act as navigator on the ocean voyage.

Detroit was designed and built at the Matthews plant for Wm. E. Scripps, the well known newspaper man and manufacturer of Detroit, who for a long time has contemplated the construction of a power boat to conquer the western ocean. The hull dimensions are 35 feet over all, 9 ft. beam and 4½ ft. draught. In model she is practically an enlarged life boat with raised deck cabins fore and aft and a waist or bridge deck amidships. The frames are 2 in. by 2½ in., spaced on foot centers. The planking is 1¾ in. yellow pine below the waterline and 1½ in. cedar above. The bilge stringers and clamps are of yellow pine and are extremely heavy. Deck planking is 1½ in. pine, canvas covered, laid over 3 in. by 4 in. deck beams.

The interior quarters are very meager and consist of two built-in berths forward in which compartment will be stowed most of the stores and provisions. In the engine compartment is a pipe berth. Underneath the midship deck are five cylindrical seamless steel fuel tanks, each with a capacity of 200 gallons of gasoline which is fed under pressure to an auxiliary tank in the engine room aft. There are also two 200-gallon tanks on either side of the bridge, which makes all told from 1,200 to 1,400 gallons fuel capacity. In the forward compartment is a tank for 150 gallons of fresh water.



DETROIT—A TRANS-ATLANTIC GASOLINER

Her power plant is a two-cylinder 16 H. P. Scripps four-cycle gasoline marine engine turning a 24 by 26 in. three-blade propeller about 500 revolutions per minute. The engine will burn about 50 gallons of gasoline on 24 hours running and in that time will cover a distance of approximately 125 miles. On this basis it is estimated that Detroit will make the voyage from New York to Queenstown, taking the regular steamship track, in about twenty days. A novel arrangement for minimizing the effect of breaking seas is the carrying of two oil tubes through the hull on either side of the stem at the waterline which connect with a sight feed oil tank on deck. The boat is rigged with a pole spar and will carry an auxiliary trysail and two jibs to be used when the winds are favorable.

DETROIT—A GASOLINE POWER BOAT INTENDED TO CROSS THE ATLANTIC OCEAN
BUILT BY MATTHEWS BOAT CO., PORT CLINTON, O.

Complete dimensions and particulars of the boat are as follows: Length over all, 35 ft.; length water line, 33 ft. 2 in.; breadth water line, 8 ft. 10 in.; breadth over all, 9 ft.; draught, loaded, 4 ft. 7 in.; draught to rabbet, 3 ft. 3 in.; depth, 5 ft. 6 in.; least freeboard, loaded, 2 ft. 6 in.; freeboard, bow, 5 ft. 9 in.; freeboard, aft, 4 ft.; fore cabin, 8 ft. 5 in.; storage space, 9 ft.; engine room, 7 ft. 10 in.; headroom, fore cabin, 6 ft.; headroom, engine room, 5 ft. 9 in.; ballast iron shoe, 1,200 lb.; mast, 32 ft.; mast housing, 7 ft.; mast, deck to truck, 25 ft.; main-boom, 16 ft.; sail area, 240 sq. ft.; fuel capacity, 1,200 gal.; tanks, five, 8 ft. x 24 in.; two tanks, 8 ft. x 18 in.; water capacity, 150 gal.

Total displacement, including fuel, stores and crew, about 25,000 lb.

Freighter for Dominion Coal Co.

Sir Raylton Dixon & Co. recently completed at Middlesbrough a bulk freighter for the Dominion Coal Co. to operate between Sydney and Montreal. Her principal dimensions are 388 ft. 3 in. long, 52 ft. beam and 29 ft. 9 in. and her carrying capacity will be about 7,600 tons. She is of cantilever construction with top side water ballast tanks. She is of the single deck type with poop, bridge and forecastle and has been built to the highest class of British corporation. She has eleven hatches and her hold is divided into four compartments. The vessel has twelve derrick posts and twenty derricks, four boats, hand and steam steering gear and is equipped with ten steam winches, steam windlass and the latest appliances for the rapid handling of cargo. The steamer is equipped with triple-expansion engines, having cylinders 26.44 and 73 in. diameters by 48 in. stroke supplied with steam by three large single ended boilers, working at 180 lbs. pressure.

The Louisiana state senate has passed a bill exempting American steamship companies from taxation in Louisiana.

Power Boat for Government Engineer

The Nemadji, built by the Racine Boat Co., of Racine, Wis., for the United States engineer office, Duluth, Minn., which was recently delivered after a satisfactory run of 700 miles, is a strictly up-to-date power tug, of the following dimensions: Length over all, 60 ft. 9 in.; length water line, 55 ft. 10 in.; extreme beam, 12 ft.; draught, 4 ft. The power plant consists of one 100-H. P., 6-cylinder, 4-cycle Standard marine engine. The tug is of heavy construction, the keel being made of clear well-seasoned white oak, sided 6 in. and tapered to 4 in. at after end, and molded to an average depth of 8½ in., 11 in. at the after end and 7 in.. where scarphed to stem knee.

The center keelson is of long leaf yellow pine, sided 6 in. and molded to a depth of 4 in., and in one length. The side keelsons are of yellow pine, sided 3 in. and molded 2½ in. Clamps of yellow pine, 2 in., molded to a depth of 6 in., and tapered forward and aft to 2 in. by 4½ in. The frames are of white oak, sided 2 in. and molded 2 in. at the hood and 3 in. at the heel, spaced 12 in. center. The bilge stringers are of yellow pine, sided 3 in. and molded 2½ in., and tapered to 3 in. by 2 in. The side stringers of yellow pine, 3 in. by 2½ in., tapered to 3 by 2 in. The stem is of white oak, sided 6 in. and molded to a depth of 18 in. The stern post is of oak, sided 8 in. The garboards are of white oak, 3 in. thick. The next two planks and the garboard are 1⅞ in. thick. The balance of the planking is 1¾ in. thick.

The planking, except garboard and sheer strake, are of long leaf Georgia pine. Two water-tight bulkheads forward and aft also help to strengthen the hull. In extreme fore peak is located chain locker, etc., aft of which is the crew's toilet, wardrobe, etc. Aft of this is the crew's quarters, with sleeping accommodations for four persons. The engine room is aft of the crew's quarters, and here also is installed and connected to the engine a dynamo of 15-volt, 15 ampere capacity, with storage battery 13 volts 120-ampere, and switchboard for lighting purposes. Suitable fixtures and lights are distributed throughout the boat.

TUG NEMADJI FOR THE GOVERNMENT ENGINEER AT DULUTH, EQUIPPED WITH STANDARD MARINE ENGINE
BUILT BY RACINE BOAT CO., RACINE, WIS.

Aft of the engine room is the galley, which is fitted with toilet, ice box, sink, cooking stove, etc. A hot water heating system is also installed in the galley, with radiators in the pilot house, crew's quarters and officers' saloon. The officers' saloon is just aft of the galley, and is fitted with desk, large folding ship table, and two Pullman berths. The pilot house is above the crew's quarters forward and is fitted with binnacle, compass, wheel, barometer, chart case, etc. Large locker seats are also provided. The finish in the pilot house and officers' saloon is antique, the engine room and crew's quarters marine white. All floors are covered with a heavy inlaid linoleum, and all seats and chairs are upholstered in leather. All equipment, such as anchors, chains, windlass, sailing lights, flags, etc., is included.

Oil Engined Vessel Eveston

The oil-engined vessel Eveston, equipped with engines of the Carels-Westgarth type, manufactured by Richardson, Westgarth & Co., Middlesbrough, was launched from the yard of Sir Raylton Dixon & Co., Middlesbrough, last month. This vessel is of the cargo-carrying type to carry 3,100 tons deadweight and at 4,400 tons displacement is to steam at 10 knots. The engines of the two-stroke Diesel system are of the open crosshead design, resembling closely marine steam practice. There are four cylinders, 20 in. in diameter by 36 in. stroke, arranged to run at 115 revolutions per minute. The scavenging air pumps and the water pump for cooling the cylinders and pistons are placed at the back of the engines and are driven by levers from the piston rod crossheads just as the pumps of a steam engine are arranged. The high pressure air compressor is placed at the fore end and is driven by a pin on the end of the crank-shaft. All the auxiliaries normally required for operating the engines are driven by the engines themselves so that it will not be necessary to run any other machine when at sea. The Eveston will compete with steam-driven vessels on a thirty days' voyage and will have many advantages over the steam-propelled boats, owing to the saving in weight despite the higher cost of oil fuel. It is claimed that there is a saving in weight of machinery of 68 tons as compared with a steam plant, while for a thirty days voyage 450 tons of coal has to be carried as against 120 tons of oil fuel, meaning 330 tons additional cargo carrying capacity.

Dock Trial of Diesel Engine

The marine Diesel engine which the New London Ship & Engine Co., Groton, Conn., built for one of the Standard Oil Co.'s barges, was given a dock trial at Port Richmond, New York harbor, recently, to the satisfaction of both builder and owner. The design of this barge follows the usual practice of the Standard Oil barges with the exception of the power plant. The hull is subdivided by nine oil-tight bulkheads into ten compartments. Eight of these compartments have tanks for carrying cargo, while the forward compartment contains cargo pump, chain locker and other equipment. The after compartment contains the heavy oil engine and fuel oil tanks.

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Wireless on Board Ship

Some definite conclusions have been reached by the International Wireless Conference which convened during the present month in London, and it is quite clear that wireless telegraphy is regaredd by the Conference as the chief life saving agency aboard ship. It is understood that among the provisions of the agreement is one for very careful regulation of the S. O. S. distress call, and in the last ten minutes of every hour wireless operators on all vessels will be compelled to keep silent in order to catch any possible distress signals. All wireless messages are to have a separate classification, such as commercial, government, navy and military. Weather observations will be given the right of way over all commercial messages. All vessels will be divided into classes and vessels of the first class will be required to carry an auxiliary wireless apparatus on the top deck. The next international wireless conference will be held in Washington in 1917. Navigators recognize the fact that an alert and intelligent wireless is the primary safeguard of life at sea. More dependence must be placed upon continual wireless service than on lifeboat equipment. A variety of causes may operate to make a lifeboat useless.

Economy in Operation

One of the big items of expense in the operation of a steamer is the fuel bill, and it is multiplied in exact proportion to the number of vessels in the fleet. Any economy that can be achieved in this direction is important, for it may mean, if not an extra dividend, at least a partial payment of interest on bonds. It will probably be recalled that in the January MARINE REVIEW we printed some figures showing what results had been secured by an intelligent analysis of the conditions existing in the engine department of a well-known line of package freight steamers. At our request, the management has now supplied us with supplemental data, which will be found in another column in this issue. The results speak for themselves and are of great interest to every vessel owner, for what is possible in the engine room of one steamer is possible in the engine rooms of many others.

Under the fierce competition of modern industrial life, the railways have taken the leading part in seeking that efficiency which makes for economy. The workmen are taught that for the price of a railway axe a car may be hauled a given number of miles; and the railway in question is allowing no item of expenditure to go unchallenged. The fuel bill, as stated, is one of the big items of operating cost; one of the three largest in fact and of the three probably the only one on which much impression can be made. The ships of their fleet represent modern practice and while not new, none are old so far as steel ships are concerned and no radical engineering changes have been made since they were built. But that was not sufficient to satisfy the railway. Could they be bettered? The data submitted present a most conclusive answer.

The lake trade is one in which large sums of money were formerly realized upon small investments. It has always been until lately a profitable business, enormously so in certain years, and if the vessel owner was careless of his operating expense, he came honestly by his indifference. But times have changed. He cannot afford to be satisfied, but must seek for economy wherever he can find it; and considering the system and conditions under which the bulk of tonnage has been constructed, he will probably find it in his engine room. There is only one way to make steam; there are a thousand ways of using or wasting it. In these days of low freights and small earnings there are doubtless a number of ships that can be made a place on the paying side and there are none whose earnings are so large as to make improvement a matter of unconcern.

Private Monopoly of Terminals

The time is fast approaching when such a thing as private monopoly of water terminals will cease to exist. The hand-writing is already on the wall. There is a growing disposition on the part of municipalities to own their own wharves; and there is also noted a jealous guardianship on the part of the Interstate Commerce Commission of the rights of individual shippers in the privately owned terminal. A notable example of private ownership is to be found in the port of Seattle. This municipality has just closed its first lease for the use of a public wharf, the lessee

being the American-Hawaiian Steamship Co. In this lease the right is reserved to require the company to give accommodations to other than its own vessels, and common use of the railroad tracks is obligatory. Rates are subject to the control of the commission and statistics as to business transacted must be submitted at stated intervals. It would seem as though the commission had safe-guarded the rights of the individual shipper in the provisions of this lease.

In this connection the Interstate Commerce Commission recently handed down an important decision in the case of the Chamber of Commerce of Mobile against the Southern railway and the Mobile & Ohio railroad, which marks quite a step forward in the abolition of monopolies in wharves and docks. To understand the importance of this decision it will be necessary to relate the circumstances surrounding the situation in Mobile. The Southern railway and the Mobile & Ohio railroad own docks at Mobile, to which they make shipside delivery on export traffic. They publish rates to and from these docks which include not only the service of carriage to Mobile, but the supplemental service of switching to their wharves, the use of the docks and the unloading of the cars. For these services no separate terminal charge is made, the value of the service being included in the one published rate. It, therefore, cannot be ascertained how much the railway charge may be for delivery to another carrier at Mobile when the shipment is destined to some other dock. The two railways work in unity at both docks, that is to say, the Southern will deliver to the Mobile & Ohio docks and vice versa.

The upshot of this arrangement was to make these docks the waterside terminals of the two railroads at which ships may call for the receipt or delivery of freight. There were ships calling at Mobile, however, that could never gain access to these docks, notwithstanding the fact that they carried freight for the railroads or were seeking freight carried by them. These ships were denied access to the docks because the docks were given over to certain preferred lines of steamships with which the railroads had made certain arrangements. These vessels were, therefore, forced to berth at other docks on the waterfront and the shipper was compelled to pay a series of charges for switching, docking and unloading, in addition to the published rate of the two railroad docks.

The result of this practice was obviously to drive export trade away from Mobile. This was the Chamber of Commerce's first cause of complaint, but there was another and equally serious one, and that was that if freight was destined via some other wharf from an interior port, the railroads would not issue a through bill of lading, although if the shipment passed over one of their own wharves for Europe by one of the preferred lines of steamships, such bill of lading would be issued.

The answer of the railroads was that they preferred one boat line over another for their own protection, but the Interstate Commerce Commission did not hold this reply to be in good faith because in the first place the through bill of lading expressly limits the railroad's liability to the land haul, and in the second place steamship lines, notably the Elder-Dempster Line, which was refused through bills of lading at Mobile, were granted them at New Orleans. The text of the Interstate Commerce Commission decision is as follows:

First, where a railroad has a wharf, to which its tariffs offer delivery and at which part of the shipping public is served, such a wharf becomes a public terminal, and if all shippers are not given access to it by the boats they choose to employ, it then becomes the carrier's duty to make delivery at other available docks at the same rate.

Second, a railroad has a right to reserve wharves for its own use and for the use of such water carriers as it prefers, provided it affords to the public access to facilities elsewhere at equal rates.

Third, where a rail carrier making a rate to a port institutes a practice of authorizing its agents to issue bills of lading for water lines, it must extend such practice to all water lines under reasonable regulation.

The report of the Interstate Commerce Commission was prepared by Commissioner Lane, who concludes as follows:

"This, then, are the things desired by the Mobile Chamber of Commerce; that the Southern and the Mobile & Ohio railroads shall make all wharves in Mobile serviceable to the export and import traffic of that port, either by making the expense of shipside delivery the same to all, or by separately stating the nature of the terminal service given by the railroads in what is known as shipside delivery, and establishing separately the charges therefor, so that those shippers who do not wish that service or cannot get it by these railroads, but do wish similar service elsewhere, may not be forced to pay extra therefor; and that in any event through bills of lading, if given via one route, shall be given via others within reasonable limitations.

"We are persuaded that where a railroad has a wharf at which its tariffs offer delivery and at which part of the shipping public is served, but to which it does not give all access, it must make delivery at the same rate at some other wharf."

This decision affects every port in the United States. The Interstate Commerce Commission took the view that if the Mobile & Ohio and Southern railroads could in Mobile say to what wharves and docks they would deliver export trade—for it practically amounts to that when an additional charge to the regular tariff is made for delivery to other wharves—that any railroad in any port could do the same thing, and only such traffic would move through the port as the railway saw fit to give it, with the result that the millions expended in harbor improvements by the general government would be for the exclusive benefit of railroads controlling the terminal situation. The ruling went into effect July 1.

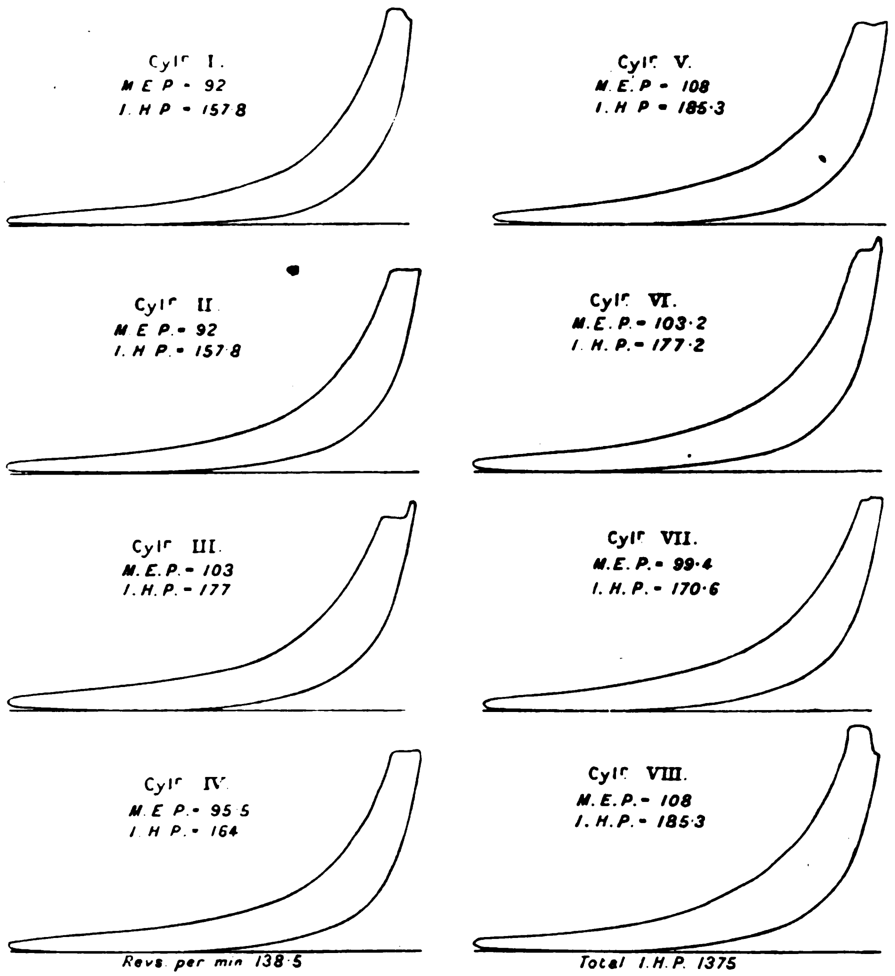
Diesel-Engined Ship Jutlandia

The oil-engined ship Jutlandia is the first British-built passenger sea-going vessel fitted with Diesel oil engines to be completed and has now concluded all her trials. She is 370 ft. in length between perpendiculars, 53 ft. beam and 30 ft. molded depth, and has been built and engined by Barclay, Curle & Co., Whiteinch, Glasgow, for the East Asiatic Co. The Jutlandia is a sister ship to the Selandia, built by Burmeister & Wain, of Copenhagen, and which was described in the May issue of THE MARINE REVIEW. The main engines of the two ships are exactly similar. The only points of difference in the installation are to be found in the method of driving and the disposition of the auxiliaries, and the pipe arrangement. The Selandia has two pumps driven by compressed air, whereas, in the Jutlandia, all the pumps are electrically driven, with the exception of the stand-by steam-driven compressor. The auxiliaries have been so disposed that the space between the two main engines is entirely clear of pumps. On the main engines a pointer is provided to show the direction of rotation, so that when this pointer coincides with another, marking the setting of the cam-shaft, fuel oil may be turned on.

The donkey boiler which supplies the steam for heating and for the auxiliary compressor, stands between the thrust-blocks. Any leakage of fuel oil from the burners of the boiler is caught in a scupper formed by a caulked angle iron.

On her trial, unfortunately, a slight mechanical breakdown, such as may happen to any engine at any time, occurred with one of the main engines just at the commencement, and the cruise was taken with only one of the main engines running. Under these onerous conditions, with only one engine and its auxiliaries running, and with the rudder over against the propeller, the ship was remarkably steady. From the set of the indicator card taken off one set of engines, published herewith, it will be seen that the mean indicated horsepower per cylinder is 172, the greatest variation in any one cylinder from the mean being 14. The mean effective pressure is 100.25 lb. per square inch, the greatest variation being 8.52 lb. The Jutlandia is constructed with a 3-ft. frame pitch, and the distribution of material proved to be effective under the conditions mentioned.

All the trials had previously been successfully passed, and a speed of 12 knots was then maintained for some hours, the main engines developing nearly 2,800 indicated horsepower with a consumption of fuel oil at the rate of 10 tons for 24 hours running. This figure includes rightly the fuel oil required by the auxiliary Diesel engines to generate the current for working the auxiliaries of the main engines. This consumption works out at 0.4 lb. per brake horsepower per hour (assuming a mechanical efficiency of 84 per cent), a remarkably good result. The oil used was Scotch shale oil, of a specific gravity of 0.855, but in ordinary service the engine will use the heavier oils obtained at Bangkok.



SET OF INDICATOR CARDS FROM THE ENGINES OF THE JUTLANDIA

Bonds on Canadian Steamers

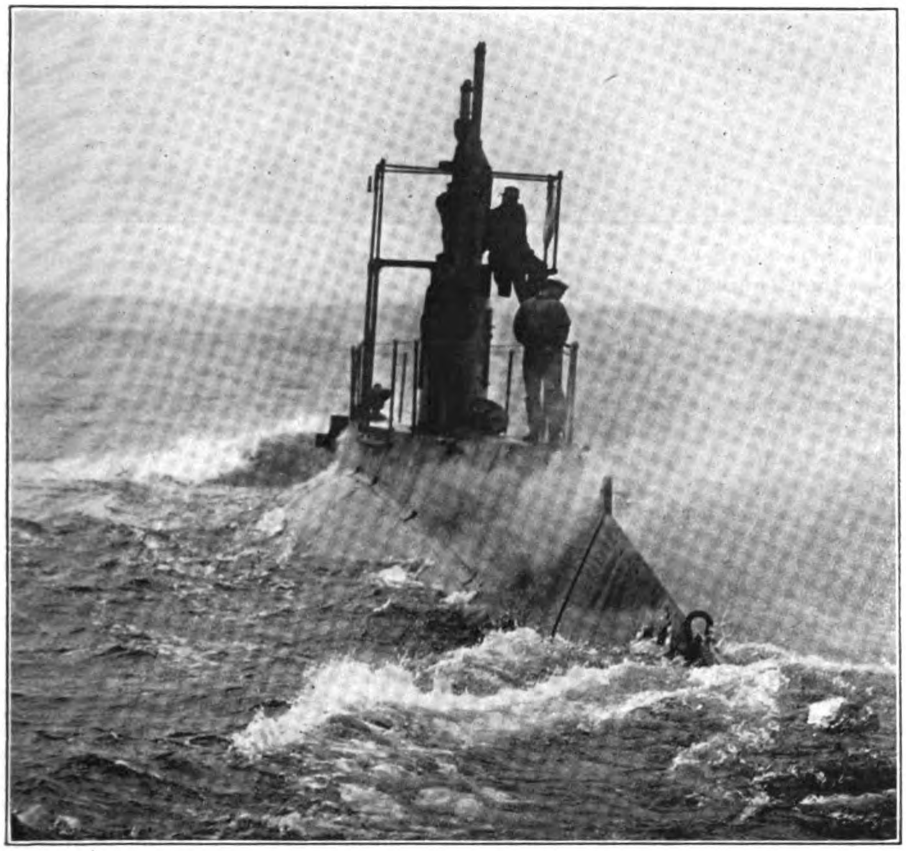
The Canadian Interlake Line, Ltd., managed by Norcross & Co., of Toronto, are floating an issue of \$520,000 of 6 per cent first mortgage 15-year sinking fund bonds, secured by the steamers Canadian, Acadian, McKinstry and Renvoyle, which are now in service, and the Indian, Hamiltonian and Calgarian, now building. The value of the first four is given as \$584,683, and the last three, \$458,275, a total of \$1,042,958. The average net earnings of the Canadian, Acadian, McKinstry and Renvoyle have been \$57,485. During 1911 they earned \$62,797.40. The annual net earnings for the Indian, Hamiltonian and Calgarian are estimated at \$60,000 and the net earnings of the whole fleet in an ordinary year are estimated at \$120,000. The combined carrying capacity of the fleet is 825,000 bu. and their regular route would be between Montreal and Port Arthur and Fort William. The Hamiltonian and Calgarian are building at the yard of the Western Ship Building & Dry Dock Co., at Port Arthur, Ont., and the Indian at the yard of the Clyde Ship Building & Engineering Co., Port Glasgow, Scotland.

The Johnson Iron Works, New Orleans, has recently completed a steel sternwheel steamer, 100 ft. long, 24 ft. beam and 4 ft. deep, for service in Mexico. They have also completed a river steamer for the Mississippi River Quarantine Commission, 135 ft x 28 ft x 5 ft., and a steel barge 100 ft. long, 35 ft. beam and 5 ft. deep for service in New Orleans harbor.

Trials of Submarine F-3

The First Vessel of Its Type to be Built in Puget Sound—Its Performances Satisfactory

Unusual interest has attached to the present official government trials of submarine F3, because this diving craft is the first of this type ever built on Puget Sound. F3 was built at Seattle by the Seattle Construction & Dry Dock Co., under the plans and the contract held by the Electric Boat Co., of Groton, Conn. Following successful preliminary tests, the submarine has performed satisfactorily to designers and builders thus far and it is believed that the government board will have no hesitancy in recommending the acceptance of the vessel by the navy department.



SUBMARINE F-3 UNDERGOING HER TRIALS IN PUGET SOUND
Photo by Webster & Stevens, Seattle

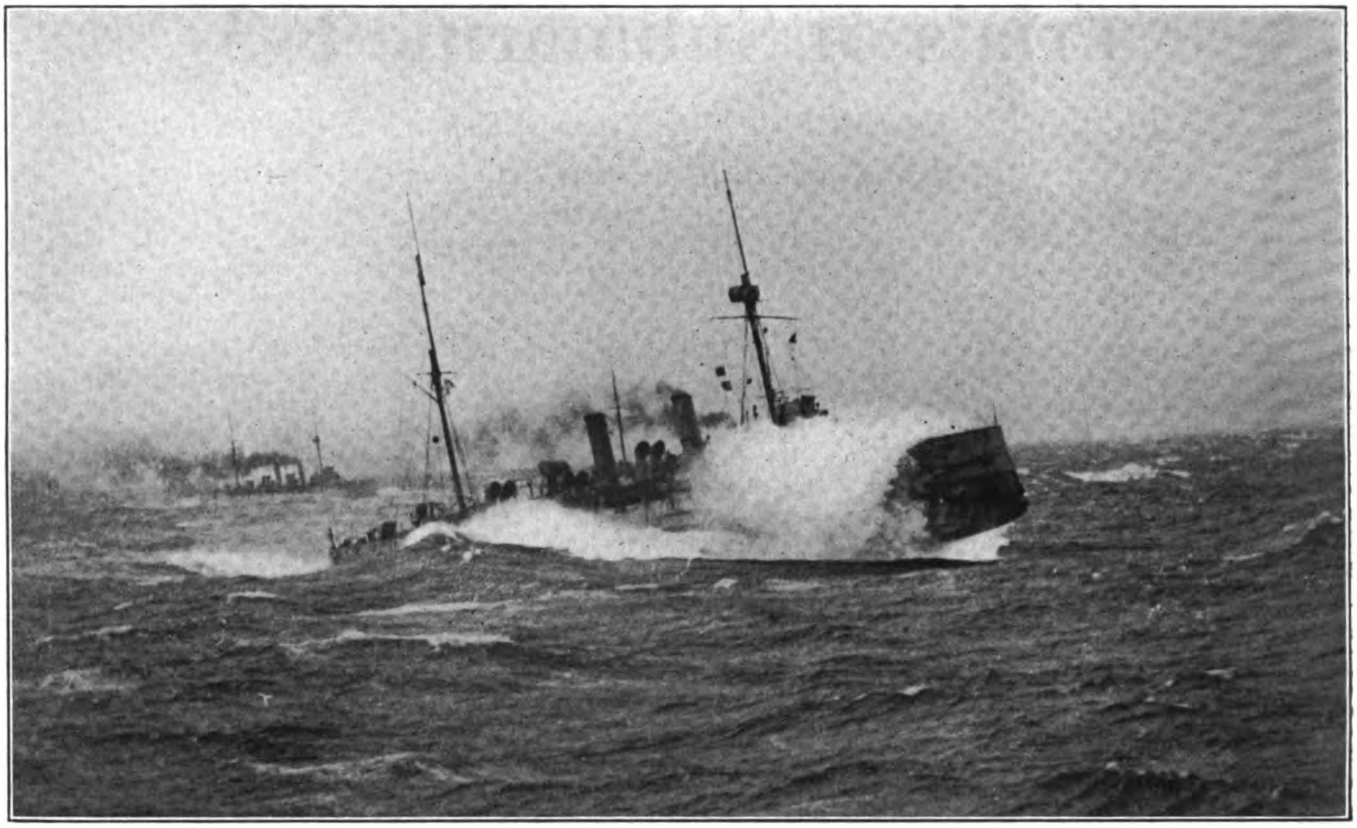
Already F3 has been subjected to several of the tests required by the government and shortly it is expected to complete the final trial. This is being done under the direction and observation of a government trial board, of which Capt. C. F. Pond, United States navy, is the president. Not a few vessels, filled with interested spectators, have followed F3 in her wanderings about Puget Sound and Elliott Bay, for the submarine is a strange craft in these waters.

Work on F3 and F4, the contract for which was awarded at the same time, has been held back by the rejection by the government of defective engine material, including a defective crank shaft. This, it is stated, was the fault of neither designer nor builder, both of whom have been extremely conscientious in trying to meet with every requirement of the government.

The official trials of F3 were begun June 17. The vessel was first sent to Port Townsend, 39 miles down Puget Sound, where the Electric Boat Co. has had a nautical mile laid out. This mile was checked for the government by the coast and geodetic survey service and pronounced correct. This course was used for trials under a light condition, awash condition and finally a submerged condition. Part of the course was used for determining the vessel's turning radius, these trials being made after standardization. Following this the submarine returned to Seattle for further trials in Elliott Bay, using the plant of the Seattle Construction & Drydock Co. as a base. These trials included four hours full speed fuel consumption test, three hours battery discharge, one hour submerged at high speed and finally balancing under the surface at various depths. Then followed a 24-hour endurance trial in the Straits of San Juan de Fuca, beyond the limits of Puget Sound, to conform with the requirements of a trial in the open sea.

During one of the trials dummy torpedoes were fired by F3's tubes. Instead of using the regular torpedoes in vogue in the navy, the loss of which fixes a heavy penalty upon the builders, the Electric Boat Co. obtained permission to use dummy torpedoes. Consequently several cast iron dummies have been made and it is stated that these are sufficient to demonstrate whether or not the tubes operate satisfactorily. Tests yet to be made include those of submerging to a depth of 200 ft., finding the center of gravity by inclining the vessel under water and trials at a depth of 15 ft. When the craft is submerged to a depth of 200 ft. with a crew inside, an extremely heavy weight is dropped to the bottom by means of which the submarine pulls herself to the bottom with a motor windlass. During this test those inside are in telephone communication with the surface and, should anything go wrong and necessity require, the cable can be instantly severed with a cable cutter. At 200 ft. the pressure is 92 lb. to the square inch, which speaks for itself as to the strength of construction in these vessels.

From unofficial information it is learned that on the first trial over the course the required speed was attained. This is regarded as a most satisfactory achievement as the heavy oil burning engines come to this coast assembled. To place them in the boat they must be taken apart and rigged up perfectly. F3's preliminary trials covered a period of but ten days for the purpose of tuning up and adjusting the machinery. According to the same source, F3 developed a surface speed of over 14 knots, while, submerged, she did



A Remarkable Snapshot of a Warship's Ram Out of Water
The British Cruiser Pegasus of the Australian Station in a Rough Sea in Australian Waters

better than 11 knots. It is stated that these trials were very satisfactory, although under the confidential contracts by which this work is being done, the government specifications and requirements are not made public. As heretofore stated these submarines are propelled by 6-cylinder, 4-cycle, heavy oil burning, internal combustion engines of the Diesel type.

That the staunchest construction is required is evident by the hazardous nature of the employment of these craft. For instance, the water ballast tanks are tested to 75 lb. to the square inch, while the fuel tanks are subjected to the same test in addition to 15 lb. of air. The motors are all built to the stringent tests of the Electric Boat Co., in addition to 100 per cent overload. Every rivet and every piece of material is thoroughly inspected and no work done for the government is so closely watched as is that in these submarine vessels.

The Electric Boat Co., under its government contracts, is building two more submarines at the Seattle Construction and Dry Dock Co.'s plant. No. 30 is about 65 per cent completed and No. 35 is about 25 per cent completed. F4, which was launched with F3, will be ready for preliminary trials Aug. 22, and it is expected to have her ready for the official trials about Sept 7. In addition to building four submarines at San Francisco, the Electric Boat Co. is building at the Seattle plant two submarines for the Chilean government. These are already about 15 per cent completed.

British Committee on Bulkheads

The president of the British board of trade has appointed a technical committee to advise him in the interests of safety of life at sea with regard to the internal sub-division of vessels of all classes by watertight bulkheads and other means. The reference to the committee is to advise:

(1) As to what, in their opinion, would constitute efficient sub-division with regard to each of the classes of vessels included in the rules for life-saving appliances made by the board of trade under Section 427 of the Merchant Shipping Act (1894), having due regard to the nature of the service in which they are respectively engaged.

(2) Whether, independently of the foregoing, the committee desire to make any recommendation with reference to the sub-division of vessels already built or new vessels, which would, in their opinion, contribute to the safety of life at sea.

The committee is constituted as follows:

Archibald Denny, of William Denny & Bros., Dumbarton, naval architect (chairman).

James Bain, late superintendent engineer of the Cunard Line, engineer.

H. R. Champness, assistant director of naval construction, admiralty.

G. B. Hunter, of Swan, Hunter & Wigham Richardson, Ltd., Wallsend-on-Tyne, naval architect.

Summers Hunter, of the Northeastern Marine Engineering Co., Ltd., Wallsend-on-Tyne, engineer.

J. Foster King, chief surveyor of the British Corporation for the Survey and Registry of Shipping.

Andrew Laing, of the Wallsend Slipway & Engineering Co., Wallsend-on-Tyne, engineer.

W. H. Luke, of John Brown & Co., Ltd., Clydebank, naval architect.

S. J. P. Thearle, D.Sc., chief ship surveyor of Lloyds Register of British and Foreign Shipping.

J. J. Welch, professor of naval architecture, Armstrong College, Newcastle-on-Tyne.

It is recognized among naval architects and ship builders that the inquiry should delve deeply into:

(1) The design and construction of watertight bulkheads, with special reference to those having very large unsupported areas, not backed up by

decks at near intervals. In the Titanic the inter-boiler-room bulkheads were peculiarly of this character, and it is difficult to see that they needed less framing and constructional support generally than an equal area of the side skin of the ship.

(2) The necessity for wing bulkheads, deemed necessary in warships, and proved practicable in the Mauretania and Lusitania.

(3) The presence of doors in the principal bulkheads, and the arrangements by which it becomes possible for them to be re-opened while danger continues.

(4) The liability to leakage by reason of pipes taken through the bulkheads at various levels for steam, hydraulic, pumping, sanitary and other services.

Electric Drive for Lake Freighter

The successful introduction of the oil engine for marine propulsion is evidently wrapped up with some form of transmitting gear precisely as in the case of the petrol engine in land transport. Attempts are, of course, being made to so re-design the oil engine for marine work that it may run slow and reverse, but it cannot be said that the success attained in any except fine lined vessels has been such as to justify the move. When it becomes necessary to consider the case of such full forms of hull as are usual in barges, canal freighters, and so forth—and this is perhaps the most natural field for the crude oil engine—then some form of transmission gear between the engine and the propeller is desirable. Parson's experiments in this connection with turbine engines are well known and the work of Westinghouse, McAlpine and others on similar lines and of Foettinger, Janney and others in hydraulic mechanisms for the same purpose are equally important. It has remained for the General Electric Co., in America, and Mavor, in England, to work out for this purpose a scheme of electrical transmission which, though a more radical departure, offers greater possibilities than any other method. The splendid results already obtained by Emmett, and the practical investigations carried out by Mavor, on the Clyde, have not only placed the feasibility of the electrical drive for marine propulsion beyond dispute, but have also indicated lines of progress in the art leading to revolutionary results.

For some years John Reid & Co., of New York and Montreal, have advocated the electrical drive for the Canadian canal type of boat to the development of which they have devoted much time and ingenuity. Therefore, the recent placing of a contract in England for a Canadian canal freighter with Diesel engine and Mavor electric gear on arrangements proposed by John Reid & Co., and to plans and specifications approved by them, is a development of great significance, not only in the Canadian trade, but in shipping generally. There will be two high-speed six-cylinder Diesel generating engines developing about 350 H. P. each at 400 revolutions per minute, with their dynamos and exciters, while the propeller shaft will be fitted with a special squirrel cage induction motor for 80 revolutions per minute. The outstanding facts in this arrangement will be that externally and for all purposes of propulsion and maneuvering the hull and the propeller will be indistinguishable from an ordinary steam job, and what that means in the lake and canal trade anyone who has experimented with unusual types of vessels will easily realize. Each Diesel engine will run on its governor at a steady rate of revolutions and of course there is no reversing necessary. One engine can be cut out for adjustment without interfering with the other, and with very little loss of speed. This is most important and greatly improves the working and efficiency of the Diesel engine.

The saving in weight of engines and fuel over steam of same power runs to about 200 tons, fewer men are required in the engine room crew, the boilers with all their disadvantages are at last discarded, and the valuable boiler space occupied in a steam job is available for cargo.

The advent of this unique vessel on the lakes will be awaited with great interest, and in passing it should be noted that the extraordinary disabilities which the hopelessly inadequate St. Lawrence canals have imposed on the Canadian lake owner have incidentally been the means of hastening this revolutionary development in marine propulsion.

Steamer Henry Williams

The Baltimore & Carolina Steamship Co., Baltimore, have just added to their fleet the steamer Henry Williams, built to their order by the Harlan & Hollingsworth Corporation, Wilmington, Del., and intended for trade between Baltimore, Georgetown and Charlestown, S. C. The new steamer is 241 ft. over all, 235 ft. between perpendiculars, 39 ft. beam and 28 ft. deep, and is of the shelter deck type with three decks designed for cargo. There are four hatches. The steamer has hoisting machines and large cargo ports with air ports and doors in the upper part for thoroughly ventilating the cargo space, besides having ventilators.

The sleeping quarters for the members of the crew are situated in the forecastle with separate quarters for the firemen and seamen and separate mess rooms in the deck houses. Each is provided with a separate shower bath. The officers' quarters are in the deck house. The pilot house and captain's room are situated on the boat deck with a flying bridge on top of the pilot house.

The engines are of the triple-expansion, surface-condensing type, having cylinders 17, 27 and 44 in. diameters by 30-in. stroke. The cylindrical return tube boilers are each 11 ft. 3 in. diameter by 10 ft. 9 in. long, allowed 180 lb. working pressure. Each boiler contains two suspension type furnaces of 46 in. outside diameter and each attached to separate combustion chambers. Air and bilge pumps are on the main engine and other pumps are independent.

Lloyds Register of American Yachts

Lloyds Register of American Yachts has now reached its tenth edition and is just from the press of this great classification society. The total number of yachts registered this year is 3,533, about 60 per cent being in the power division. The relative decrease of the sailing yacht becomes more rapid each year. The changes from last year are for the most part made of dropping a number of the older sailing yachts, both large and small, and the addition of several sizes of gasoline cruisers, notably the raised deck launch of 28 to 35 ft. length and the cruiser of 75 to 100 ft. length. The additions to the sailing division of the fleet are comparatively unimportant. The clubs listed in the Register now include 578 yacht clubs and 39 associations and miscellaneous organizations. The burgees of these clubs to the number of 500 make up 13 color plates, and two more plates are devoted to the national ensigns, the international signal code and the weather bureau signals. The private signals of yachtsmen to the number of nearly 2,000 are also given in color, while the names and addresses of 3,350 owners are published. The Register also contains the American yachting trade directory.

Data of Battleship Florida's Trials

The battleship Florida, which was built at the New York navy yard under the supervision of Naval Constructor W. J. Baxter, underwent the official trials on March 23, in a rough sea and brisk wind off the Maine coast. In her four-hour trial at full speed she maintained an average of 22.08 knots, reaching a maximum of 22.54 knots which is said to be a world's record for a battleship, the British battleship Vangaurd having hitherto held this record with a speed of 22.50 knots. The following synopsis and average data has been deduced from her trials by the navy department.

U. S. S. FLORIDA OFFICIAL TRIALS, SYNOPSIS AND AVERAGE DATA

	4 hr. trial at full power.	24-hr. trial at 19 knots.	24-hr. trial at 12 knots.
Steam pressures.			
Pressure at boilers, gage	210.	202.	203.
Pressure at M. H. P. turbine, abs	173.	....	17.2
Pressure at H. P. cruis. turbine, abs	10.8	....	144.4
Pressure at I. P. cruis. turbine, abs	13.7	....	49.7
Pressure at L. P. turbine, abs	18.5	....	5.0
Pressure in oil system, gage	13.3	13.5	11.05
Vacuum, inches	28.4	28.6	29.6
Barometer, inches	30.2	30.1	30.4
Air pressure in fire rooms, in. of water	1.99	0.6	0.00
Auxiliaries, revolutions or double strokes.			
Main air pumps, double strokes	23.3	18.8	17.3
Main feed pumps, double strokes	26.3	20.6	16.2
Main circulating pumps, revolutions per minute	243.	200.8	161.8
Dynamo engines, revolutions per minute	1500.	1500.	.....
Forced draft blowers, revolutions per minute	712.	573.	.....
Oil pumps	43.	38.2	21.2
Temperatures.			
Injection, degrees Fahr	39.8	52.	45.
Discharge, degrees Fahr	64.2	67.4	56.7
Air pump discharge, degrees Fahr	66.9	71.3	55.6
Feed, degrees Fahr.	197.9	200.6	123.3
Engine room, working level, degrees Fahr	86.8	98.4	94.1
Fire room, working level, degrees Fahr	79.	98.	100.
Horsepower.			
Total shaft horsepower, main engines	40511.0	19359.0	4433.0
Total indicated horsepower, auxiliaries	1299.0	863.0	464.0
Total horsepower, all machinery	41810.0	20222.0	4897.0
Water.			
Pounds per hour, main engines	493428.0	251669.0	74543.0
Pounds per hour, auxiliaries	67352.0	56382.0	41843.0
Pounds per hour, all machinery	560880.0	308051.0	116386.0
Pounds per hour per shaft horsepower, main engines	12.18	13.0	16.81
Pounds per hour, per indicated horsepower, auxiliaries	51.85	65.33	90.18
Pounds per hour, per horsepower, all machinery	13.415	15.23	23.76
Deduced data.			
Shaft horsepower per square feet, G. S.	28.369	13.557	4.657
Pounds of coal per shaft horsepower per hour	1.644	1.793	2.463
Pounds of coal per horsepower per hour	1.593	1.717	2.23
Pounds of coal per square foot G. S.	46.63	24.314	11.47
Cooling surface, square feet per shaft horsepower	0.752	1.574	6.87
Pounds of water, evaporated per pound coal per hour	8.423	8.872	10.658
Number of boilers in use	12.0	12.0	8.0
Speed in knots per hour	22.08	19.19	12.08
Knots run per ton of coal	0.743	1.238	2.478
Revolutions per minute	363.9	289.5	178.51

Double bottom and feed-water tanks are fitted under boilers. Peak tanks arranged for the carrying of fresh or salt water. Coal bunkers are abreast of boiler room and a cross bunker aft of boiler room. Drinking water tanks contain 4,000-gallons of fresh water and gravity tank 500-gallons. Refrigerator space has capacity of 550 cu. ft.

Propelling machinery is placed amidships and consists of two single-ended Scotch boilers, arranged fore-and-aft, with fireroom between the two. They are 16 ft. in diameter and 11 ft. between heads, working pressure 200 lbs. Engine is of the vertical, inverted - cylinder, triple - expansion, surface-condensing type, of about 1,800 H. P., with cylinders 19¾, 31½ and 54¼-in. diameter, respectively, with a common stroke of 63-in.

New Service to South America

The Mississippi Valley, South America & Orient Steamship Co., 806 Gravier street, New Orleans, La., has been organized to establish a monthly service between gulf ports and South America. It has chartered the freighter Inkum, of 8,400 tons, and the vessel left New Orleans with a full cargo during the latter part of June. It is stated that the Inkum is the first general cargo carrier to sail from any gulf port to the east coast of South America since the civil war. James W. Porch, president of the company, says that it is the eventual intention of the company to operate a service under the American flag from the Mississippi valley through New Orleans, its natural gateway, to the east coast of South America. Gale Aiken Jr. is secretary of the new company, Walter J. Manion treasurer and R. J. Cobb traffic manager.

Leasing Seattle Public Wharves

The Seattle port commission, which since its inception and organization last December has been planning and making preliminary arrangements for a great scheme of harbor improvement, has closed its first lease for the use of public wharves. The lessee is the American-Hawaiian Steamship Co., which operates the largest fleet of ocen-going vessels flying the American flag. The commission's contract gives the steamship company the right to use for ten years, at an annual rental of $30,000, one-half of what is known as the East Waterway improvement.

In entering into this agreement the commission said in part in an authorized statement:

"This agreement is probably the most carefully prepared document of the kind ever drawn. It is free of every feature of monopoly characterizing the ordinary long-term lease. The term itself is the shortest which the law allows. The right is also reserved to require the company to give accommodations to other than its own vessels. Common use of the railroad tracks is obligatory. Statistics of business must be furnished. The question of rates is subject to control by the commission. In all minor details the rights of the public are effectually safeguarded and there is nothing in the contract to which the most ardent friend of public ownership can take exception.

"Another consideration which should not be overlooked is that this contract makes the property in question absolutely self-sustaining from the start. The increase of taxation to sustain the bond issues authorized last March has given the commission much anxious thought and it is seeking to reduce that burden as rapidly as possible. The arrangement just made is an absolute certainty so far as it goes. It will fully pay the interest and bond retirement from the moment it goes into effect and this relieves the taxpayers of that charge. This might result, it is true, under direct operation and probably would after a time, but this contract makes it a certainty from the start."

While there is a considerable public ownership sentiment in Seattle, the terms of the agreement with the American-Hawaiian line appear to safeguard the city's interests to such a degree that no opposition to this arrangement has appeared. This line makes its terminus at Seattle and does a large business to Puget Sound. Upon the opening of the canal it will operate through that waterway from the Atlantic coast, abandoning its present route via the Tehuantepec railroad. This company has increased its business to North Pacific ports by leaps and bounds during the last five years, and its present water terminals in this city are already greatly cramped, although they were

more than ample when the present lease was executed about five years ago.

It will be some time before the wharf which the A-H company will use will be ready as work has not yet been started on it. The site is well within the industrial limits of Seattle and it has excellent railroad connections. The improvement proposed on this site provides for the dredging of a slip 221.4 ft. in width eastward from the East Waterway and the construction of wharves and sheds on each side thereof. Each shed will have a ground floor area of 85,913 sq. ft. The frontage at the outer ends of the wharves and on the sides fronting on the slips will make desirable landing space for local and small coastwise vessels. The plan also provides a berthing length of 983 ft. on each side, making a total of 1,966 lineal feet of dockage in addition to approximately 600 lineal feet which may be devoted to local vessels. The sheds are to be supported on creosoted pile wharves and foundations. It is proposed to use creosoted timber and riprap or brush in the bulkheads and slopes. The estimated cost of this improvement, including land to be acquired by condemnation and providing a safe margin for other contingencies is $850,000. This improvement is but one of several planned for Seattle harbor, the total of which will be approximately $3,000,000.

Some Interesting Figures

Information as to the results of the further modification in the ships of the Erie Railroad Transit Line, referred to in THE MARINE REVIEW for January (p.9) is at hand and certainly makes interesting reading. The work was instituted by and carried out under the direction of Babcock & Penton, consulting engineers to the Erie railroad, and following upon the observations and experiments of the season of 1911, tabulated in THE REVIEW.

Ships C and E (see table, p.9) were selected for attention during the winter, and as a result of the alterations C's fuel consumption has been further reduced from 191 tons per trip for 1911 to 145 tons per trip in 1912, a reduction of 24 per cent, or of 29 per cent as compared with 1910. A further increase in speed of 0.75 mile per hour has also accrued from the increase in revolutions due entirely to the modifications in steam distribution, the engines being worked for all ordinary service at shortest possible cut-offs. No changes whatever were made in the boiler plant in this case, although plans are under consideration for certain alterations next winter.

Ship E's fuel has been further reduced from 230 tons per trip for 1911 to 165 tons in 1912, a reduction of 29 per cent, or of 36 per cent as compared with 1910. Even more remarkable is the increase of 1.75 miles per hour in speed in spite of a reduction of 20 per cent in the minimum cut-off, at which the engines have been steadily worked. The increase in revolutions has been about nine per minute and is due entirely to improved valve design and steam distribution, the working steam pressure being unaltered. Since the resultant speed is too high for average service the only way it can be reduced is by lowering the boiler pressure or by throttling, a condition which it is perfectly safe to say will be regarded as unusual, to say the least.

The ship has steamed from Buffalo to Cleveland, over 180 miles, at better than 11 miles per hour with less than half boiler capacity in service, the remaining fires being worked with an air pressure of only about ⅛ inch at the ashpits. No attempt was made to get higher speed, the ship not being required to be in Cleveland before 7 a. m. The reduction in bunker capacity has also added directly about 50 tons of cargo space between decks, an item of considerable value in handling package freight.

Ship D has further reduced her fuel consumption about 15 tons, an overall reduction of 32 per cent as compared with 1910.

The coal and personnel are the same as during the season of 1911 with the exception of one change in the latter.

THE REVIEW hopes to present further data, including the other ships of the fleet, later. Meantime it may be noted once more that both C, E and D are modern steel ships with high grade machinery, having no radical defects of design or construction and their work was certainly not inferior to the average of similar ships.

The line has added a fuel lighter and coal dock facilities to its equipment and now handles its own fuel. The lighter carries 100 two-ton buckets and a McMyler hoist.

Isherwood Patent Granted

J. W. Isherwood, on June 11, was granted a patent on his system of longitudinal ship construction by the United States patent office. Eight vessels have already been built in this country upon this system, four at Newport News, one at Baltimore, one at the Ecorse yard of the Great Lakes Engineering Works, at Detroit, and two at the Lorain yard of the American Ship Building Co. The following ship yards have under way or under order vessels for construction under this system: Fore River Ship Building Co., Quincy, Mass., 1; New York Ship Building Co., Camden, N. J., 1; Wm. Cramp & Sons Ship & Engine Building Co., Philadelphia, 1; John H. Dialogue & Son, Camden, N. J., 3; Maryland Steel Co., Sparrow's Point, Md., 12; Newport News Ship Building & Dry Dock Co., Newport News, Va., 3; James Rees & Sons Co., Pittsburgh, Pa., 3; American Ship Building Co., Cleveland, 12; and Western Ship Building & Dry Dock Co., Port Arthur, Ont., 3. The American Ship Building Co. is the licensee of this patent for the great lakes.

Contract for Bulk Freighter

The Pittsburgh Steamship Co. gave contract to the American Ship Building Co. during the month for a 600-ft. steamer, being the third that it has under construction for 1913 delivery. This steamer will be built on the Isherwood system of construction and will be 600 ft. over all, 580 ft. keel, 58 ft. beam and 32 ft. deep, and will be built at the Lorain yard.

Following his practice of enlarging the average carrying capacity of the fleet, President Harry Coulby has disposed of three of the smaller vessels, the steamers Maruba and Corsica and the barge Malta.

The council of the Society of Naval Architects and Marine Engineers has elected the following vice presidents and members of council to fill existing vacancies: Vice presidents: Capt. A. P. Niblack, vice Rear Admiral Evans (deceased), George W. Dickie, vice Rear Admiral Melville (deceased); members of council: Commodore L. H. Chandler, vice George W. Dickie (promoted), Capt. C. A. McAllister, vice W. A. Post (deceased); associate members of council: Henry S. Grove, vice Capt. A. B. Niblack (promoted).

The Montreal Dry Dock & Ship Repairing Co. has just been incorporated with a capital of $50,000. The officers are J. T. Walsh, president; A. Larocque, vice president; F. H. Fox, secretary and treasurer; Thomas Hall, managing director. The company has secured a ten-year lease on the Tate dry dock on the Lachine canal.

Capt. J. J. H. Brown Passes Away

Capt. J. J. H. Brown, former president of the Lake Carriers' Association, died at Buffalo on June 11. He had been a conspicuous figure in lake circles for the past 50 years. He was born in Cleveland on Feb. 9, 1838. He was attracted to the sea at the early age of 14, sailing around the world in merchant vessels and whalers. He returned to the lakes when he was 20 and began sailing on lake ships. In 1873 he was appointed master of the Scotia, at that time the largest schooner on the lakes. In 1878 he entered into partnership with Capt. Daniel Rogers as vessel agents. On the death of Capt. Rogers, in 1885, he became associated in the same business with Edward Smith, under the firm name of Brown & Co. Capt. Brown was elected

Capt. J. J. H. Brown

president of the Lake Carriers' Association in 1896 and was chosen president of the Buffalo chamber of commerce in 1904. At the time of his death he was a member of the executive committee of the Lake Carriers' Association. His funeral was largely attended by vessel owners from all over the lakes and all the vessels enrolled in the Lake Carriers' Association fleet carried flags at half mast.

The Year's Ship Building

During the year ended June 30, 1912, there were built in the United States and officially numbered by the Bureau of Navigation, 1,702 merchant vessels of 243,792 gross tons, compared with 1,208 of 302,158 gross tons for the same period of 1911, showing a loss of 58,366 tons.

Of the 35 metal vessels built on the great lakes, the Col. James M. Schoonmaker and William P. Snyder Jr., each of 8,603 gross tons, are the largest on the lakes. Fourteen others of 30,029 were built for the Atlantic trade.

Over 50,000 gross tons of sailing vessels were lost at sea during the year, equivalent in tonnage to vessels built of this class for the last three years. Following is the summary:

	Wood						Steel							
	Sail.		Steam.		Unrigged.		Sail.		Steam.		Unrigged.		Total.	
	No.	Gross.	No.	Gross.	No.	Gross.	No.	Gross.	No.	Gross.	No.	Gross.	No.	Gross.
Atlantic and Gulf	75	14,818	410	15,448	118	30,692	3	2,040	33	39,682	13	7,765	652	110,445
Porto Rico	4	65	2	30	...	......	.	.....	..	......	..	.....	6	95
Pacific	10	1,158	333	15.088	161	14,247	.	.....	10	3,658	..	.....	514	34,151
Hawaii	..	.....	.	.	...	.	.	.	.	.....	..	.....	...	......
Great Lakes ...	4	38	261	3.919	64	6,013	2	4,057	31	79,223	2	1,308	364	94,558
Western rivers..	.	......	151	3,779	26	410	.	.....	7	354	.	.....	184	4,543
Total	93	16.079	1.157	38,264	369	51 362	5	6.097	81	122.917	15	9,073	1,720	243,792

During the corresponding year ended June 30. 1911, 1,208 sailing, steam and unrigged vessels of 257,938 gross tons were built in the United States and officially numbered, as follows:

	Wood						Steel							
	Sail.		Steam.		Unrigged.		Sail.		Steam.		Unrigged.		Total.	
	No.	Gross.	No.	Gross.	No.	Gross.	No.	Gross.	No.	Gross.	No.	Gross.	No.	Gross.
Atlantic and Gulf	65	8,156	432	18,990	90	25.907	4	2,208	66	114,581	7	2,138	664	171,980
Porto Rico	6	156	3	26	..	......	.	......	..	......	.	.....	9	182
Pacific	8	823	277	9,372	133	7,020	.	.....	9	12,392	.	.....	427	29,607
Hawaii	.	.....	1	22	...	.....	.	......	..	......	.	.....	1	22
Great Lakes	2	55	142	2,467	48	7,307	.	.....	44	83,134	4	1,409	240	94 372
Western rivers..	.	.....	146	4,375	36	439	.	.....	3	1,181	.	.....	185	5,995
Total	81	9.190	1,001	35.252	307	40,673	4	2,208	122	211,288	11	3.547	1,526	302,158

Fishing Steamer Frank Perry

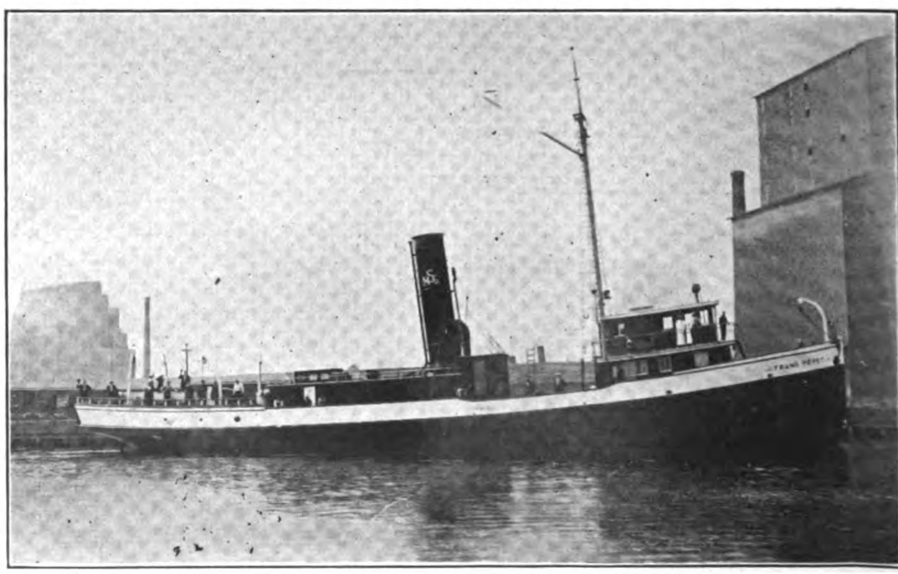
Lake marine men will hardly recognize the accompanying photograph as that of the large tug Frank Perry, formerly located at Sault Ste. Marie, Mich. The Perry was purchased last winter by the Southern Menhaden Co., of Jacksonville, Fla., and was taken to Manitowoc at the opening of navigation, where the Manitowoc Ship Building & Dry Dock Co. cut her down to the main deck and reconstructed her to be adapted to the fishing business.

The work included new surface condenser and a general overhauling of the engine room for salt water purposes, new quarters for the crew, a 75-ft. spar, arrangements in the hold for the carrying of fish, new houses and general repairs and alterations to make the boat suitable for the fishing business. The alterations cost about $16,000 and make the Perry one of the most complete and modern fishing steamers on the Atlantic coast.

The menhaden or pogie is a fish caught for its oil and the residue after pressing is used for fertilizer. The fishing grounds extend from Maine to Florida. The Perry left for the coast June 29.

Bids for Gunboat

The Seattle Construction & Dry Dock Co., Seattle, Wash., was the only bidder for the construction of the river gunboat Monacacy, of 190 tons displacement. The company offered to build this boat for $212,000, or deliver it on board steamer at San Francisco for $214,500, or at Shanghai, China, for $290,000. The appropriation for the gunboat was $215,000. The navy department rejected the bids on the ground that the bids



Fishing Steamer Frank Perry
Remodeled by the Manitowoc Ship Building & Dry Dock Co.

actually within the amount of the appropriation did not leave sufficient margin to defray other necessary expenses. The navy department thereupon accepted the bid of the Mare Island navy yard at $141,000. The Seattle Construction & Dry Dock Co. has protested against this proceeding, claiming that the gunboat cannot be built for $141,000 and that this estimate should not be considered in competition with the bid of a private ship builder. The matter has been placed before President Taft, who is now giving it consideration.

Matson Life Raft

A life raft designed by H. J. Matson was recently tested out on the battleship Rivadavia, building at the yard of the Fore River Ship Building Co., Quincy, Mass., the navy department being represented by Naval Constructor Lloyd Bankson. The Matson raft is constructed of galvanized iron and has 12 watertight compartments. It is 12 ft. long, 9 ft. wide and 3 ft. high and will carry 65 persons. The accompanying cut shows its general features of construction. At each end of the raft there is a tank, one for provisions and the other to hold enough water to sustain 65 persons for eight days. The water tank is equipped with what the inventor calls a "sucking tube." This device obviates the necessity of a bunghole and prevents the inflow of any salt water into the tank. Around the entire raft is a life line and inside are five oars and provision for rigging a sail. The top and bottom of the raft are composed of slats and, whichever way the boat lands, a simple removal of a pin will release the slats on the top. On board the liner the raft rests on a launching gear and at an angle of about 45 deg. It is set on wheels to enable it to be put overboard with the greatest possible dispatch. The launching gear is extremely simple. Heavy iron chains hold it in place, but a slight pull on a lever will release the raft and send it bounding into the sea—once in the water it immediately rights itself and passengers reach it by means of a rope attached to the steamer. Mr. Matson has perfected his launching device by stringing the rafts along in series so that one man by releasing one lever can launch four rafts, all within a few seconds. There are no pulleys, ropes or davits and the raft takes up very little room on deck. It is reported that the French line has adopted the raft as a part of its equipment.

THE MATSON LIFE RAFT

Ordered to Take Back Steamers

Judge William L. Day, in the United States circuit court, Cleveland, last month ordered the American Ship Building Co. to take back the steamers J. Q. Riddle, Abraham Stearn and Sheldon Parks from the Commonwealth Steamship Co., and to restore to the company the money that was paid to them, approximately $1,265,000. The decision was quite a surprise to the trade but Judge Day held that the American Ship Building Co. had been guilty of fraud in granting secret commissions to W. A. and A. H. Hawgood for placing contracts for these steamers. Litigation in the case has been long. It was originally started by Frank P. Whitney, a stockholder in the Commonwealth Steamship Co., who brought suit against the Hawgoods, making the Commonwealth Steamship Co. party defendant. The Hawgoods refused to answer any questions until the common pleas court ruled that they should do so, when they testified that they had received the following commissions upon steamers constructed for the Commonwealth Steamship Co.: A. H. Hawgood, $30,000; W. R. Woodford, $30,000; Sheldon Parks, $25,000; W. A. Hawgood, $25,000; Abraham Stearn, $15,000; and J. Q. Riddle, $5,000. The construction of the seventh vessel of the fleet, the H. A. Hawgood, had been promoted by Henry A. Hawgood, deceased, and no testimony upon her was submitted.

Immediately upon this confession, the suit against the Hawgoods was withdrawn and a suit against the American Ship Building Co. substituted to compel it to take back the steamers. Meanwhile four of the steamers, the W. R. Woodford, A. H. Hawgood, Henry A. Hawgood and Wm. A. Hawgood, had been sold, and in behalf of these four steamers the company seeks to recover the difference between the contract and the selling price.

Judge Day, in his decision, directed the American Ship Building Co. to pay the contract price of the three steamers left in the fleet of the Commonwealth Steamship Co., together with interest dating from the time contracts were made about five years ago. The Steamship company on its part is directed to pay to the builders the new profits of the operation of the vessels since they were built.

The Acme Transit Co., also a Hawgood corporation, has a similar suit pending against the American Ship Building Co. to require it to take back the steamers Edwin F. Holmes and H. B. Smith. The Hawgoods testified that they had received commissions of $17,500 on the Holmes and $15,000 on the Smith.

Eckliff Boiler Circulator

The Detroit, Belle Isle & Windsor Ferry Co. has installed the Eckliff automatic boiler circulator on five of their steamers and it is stated has had notable success with the Brittania, which is equipped with two Scotch boilers. The engineer states that within two hours from the time these five were put in the boiler he had 175 lb. of steam and that the temperature at the bottom of the boiler varied from 360 to 368 deg. Moreover, while formerly it was difficult to obtain sufficient steam to turn the engine 120 revolutions it is possible now to get 135 revolutions. The Eckliff circulator is of the thermo-syphon principle and is not dependent upon valves, injectors, tubes or other mechanical attachment, being governed entirely by the law of gravitation.

PERSONAL

Charles A. Moore, president of the Manning, Maxwell & Moore Co., and for many years president of the American Protective Tariff League, recently returned from Europe.

M. Seckendorf, general passenger agent of the New York & Porto Rico Steamship Co., has also assumed the duties of general passenger agent of the Clyde Santo Domingo line.

John S. Hyde, president of the Bath Iron Works, has accepted the vice presidency of the Maine Health Day Association, organized permanently to fight tuberculosis.

Frank W. Hibbs, former naval constructor, who represented the Electric Boat Co. at Seattle for several years, has been succeeded by T. S. Bailey, the Pacific coast manager of the company.

Ernest M. Bull, of A. H. Bull & Co., thinks that valuable aid could be given to the American merchant marine by conserving the business of carrying navy coal to the Philippines to American vessels.

W. D. Dickey, director and member of the executive committee of the Maritime Exchange, of New York, was recently presented with a loving cup for his services in rearranging the floor of the exchange.

Henry Harland, nephew of the late Sir Edward Harland, has been appointed head of the designing department of Harland & Wolff through the vacancy created by the death of Thomas Andrews in the Titanic disaster.

George W. Dickie, the well known ship designer of San Francisco, will be located at the yard of the New York Ship Building Co., Camden, N. J., for the next year superintending the building of ships for the Pacific Coast Co.

William I. Donnelly, consulting engineer, 17 Battery place, New York, has returned from an extensive trip to the Pacific coast and expresses himself as much impressed with the rapid progress made in the use of oil fuel there during the past year.

Arthur J. Grymes has been appointed manager of the marine department of the Erie railroad and will have charge of the company's fleet in New York harbor and the Hudson river as far as Troy, as well as of the fleet of coal barges and tugs which go as far east as Portland.

A. B. Pouch, vice president of the American Dock Terminal, Tompkinsville, N. Y., has sailed for England to confer with steamship owners who are reported to have interested themselves in an extensive project to develop the waterfront at Tompkinsville.

Capt. S. G. S. MacNeil has been appointed staff captain of the Mauretania and Capt. J. F. Simpson staff captain of the Lusitania, of the Cunard Line, in charge of discipline of crew, in order that the captain of the ship may give his undivided attention to the navigation of the vessel.

Thomas Long, vice president of the Collingwood Ship Building Co., in a recent speech urged the Dominion government to give Canadian yards protection against the unequal competition of British yards which are supplying a number of vessels for Canadian trade.

Col. Harris Weinstock, of San Francisco, in a speech before the chamber of commerce of that city, recently said that the rapid progress upon the Panama canal was due to the extreme loyalty of every worker, from the humblest to the highest, to Col. Goethals, who has carried on the great work without friction.

Julius Thomann, director of the Hamburg-American Line, announced just prior to returning to Hamburg that a provisional arrangement had been made whereby the company had executed a power of attorney in favor of J. P. Meyer, W. G. Sickel and Emil Lederer for the conduct of its business in this country, the joint signature of any two of these gentlemen to be binding.

William E. Woodall & Co., Baltimore, have launched a large pocket scow, 90 ft. long, 28 ft. beam and 9 ft. deep, for the Maryland Dredging & Contracting Co.

The Breakwater Co., of Philadelphia, has contracted with the Green Point Construction Co., of New York, for a tug to be 75 ft. long, for use in the harbor of Hilo, Hawaiian Islands.

Sir William White on Titanic Disaster

Sir William H. White, the eminent naval architect, in a letter to the London *Times* on the loss of the Titanic, says that the inquiry in America has been conducted in a manner which has justly given cause for serious criticism, but it has placed on record a mass of testimony of great value. The writer then sets out conclusions arrived at on the evidence available. In accordance with the practice adopted by the White Star line on her maiden voyages the rate of revolutions for her engines and the speed of the Titanic had been greatly increased during the outward passage.

The force of the blow which could be struck by the ship was equal to that struck by the weight of 1,000 tons falling through a vertical height of 1,000 feet. The total energy was as great as that represented by the simultaneous discharge of a dozen of the largest and most powerful guns mounted in the most recent battleships. If the Titanic had struck the iceberg end on and been stopped, this vast store of energy would have been to a great extent absorbed in the mechanical work done in injuring and deforming her own structure and in shattering portions of the iceberg. It is certain that the ship only grazed the starboard side at a considerable depth below water.

It is natural to find a lack of exact observations or records by witnesses of the time or distance of striking. Twenty to 30 seconds would suffice to put the helm hard over, and 30 seconds more would be ample for the officer of the watch to receive a message from the lookout, so that one minute elapsed between the warning and the collision, in which time the Titanic would traverse 2,200 feet, and the iceberg would have been reported by the look-out at less than four-tenths of a sea mile ahead of the ship. The graze of projecting underwater portions of the iceberg destroyed the water-tightness of the shell plating for 250 feet from the stem, and threw open the five foremost watertight compartments.

The rent in the ship's side must have been about 35 feet below the water surface, and the water would enter at 40 feet per second, so that one ton of water per second would have entered through each square foot of the area of the apertures, and thus 12,000 tons of water could enter in the first minute with free entry. The passengers and others on the decks

could have had no sense of danger from the slow sinkage of the bow. The stories of the ship having broken in two are incredible. It was a grazing blow which caused the fatal damage, and which practically destroyed the vessel by the injuries inflicted in a few seconds as a consequence of her high speed at the moment she struck the iceberg.

When the temporary excitement has disappeared it will be seen that the question of boat equipment must be treated as subordinate to that of efficient water-tight sub-division. Possibly ship owners will concur in action by which sub-division shall be made the subject of legislation on lines to be agreed upon by the board of trade and themselves. In view of the experience in connection with legislation for load-lines, it may be hoped that such action, if taken, may be of an international character.

Death of Capt. Sayre

In the death of Capt. C. E. Sayre the lakes lost one of its most experienced navigators. He was one of the most consistent students of the theory of navigation and his library on the subject was probably the most complete of any master in active service. He did not turn his attention to the lakes until he was 24 years of age, but ever since then he had been a consistent student of the science of navigation. He was born on a farm near Mason, Mich., Oct. 11, 1864, and was the son of Anglo-American parentage, his ancestors being New England settlers of colonial times. He worked on a farm until he was 17 years of age and then followed the carpenter and joiner trade, qualifying himself meanwhile as teacher of a district school of Ingham Co., Mich. At that time a family well known in lake navigation circles was living at Mason, and it was the incentive of this family which prompted him to change his vocation and become a sailor. Accordingly, with no knowledge whatever of the water, he went to Chicago in the spring of 1888 and shipped as deck hand on a lumber barge, subsequently serving as fireman, watchman and wheelsman in package freight and ore-carrying steamers. In 1892 he was appointed second mate of the steamer Pontiac and in 1893 went as first mate on the steamer Hesper. In the spring of 1897 he was appointed master of the steamer I. J. Boyce, entering the steel rail trade under the management of J. S. Keefe, in whose employ he remained the following year as master of the steamer Adella Shores. In 1899 he had command of the steamer Jessie H. Farwell, then under charter of the American Steel & Wire Co., with W. C. Richardson as manager. During the winter of 1900 he entered the employ of the Cleveland-Cliffs Iron Co., as master of the steamer Andaste, sailing her for five years. In 1905 he was transferred to the Centurion. He then brought out the Ishpeming, in 1906, sailing her for two years, after which he

CAPT. C. E. SAYRE

entered the employ of the Frontier Steamship Co., sailing the steamer Josiah G. Munro. He went in the Ontario, of the Northern Lakes Steamship Co., in 1911, and was sailing this steamer at the time of his death.

His death was extremely sudden and tragic. The Ontario was unloading coal at Milwaukee, on June 27, when the captain, apparently in the best of health and vigor, was seized with hemorrhage of the lungs, expiring in his cabin a few minutes later.

Floating Dock for British Admiralty

A gigantic floating dock has just left the Wallsend ship yard of Messrs. Swan, Hunter & Wigham Richardson, in charge of four powerful tugs, and is now on its way to the river Medway. The towing arrangements were in the hands of Messrs. L. Smit & Co., of Rotterdam. The dock is the third that Messrs. Swan, Hunter & Wigham Richardson have completed this year for the British admiralty. It may be remembered that some years ago they built another battleship floating dock with a lifting capacity of 17,000 tons which is now stationed at Bermuda. Other well-known floating docks have been constructed at the Wallsend ship yard for the governments of Southern Nigeria, Natal, Japan and Spain; and also for numerous British and foreign clients in various parts of the world.

This new floating dock, which is to be stationed in the river Medway, is quite the most complete of its kind and is intended for repairing and overhauling battleships with displacements up to 32,000 tons. A good idea of the size of the dock may be gained when it is known that it covers an area of two and a quarter acres. It is double-sided and the overall dimensions are 680 ft. in length with a width of 144 ft. The height of the walls is 66 ft. and the depth of the pontoons is about 20 ft. The weight of steel plates and angles worked into the dock is about 12,000 tons, and this, of course, is exclusive of all machinery and outfit.

At the bow end of the dock there is a pair of pivoted flying gangways to give access from one wall to the other. In the port wall of the dock is installed living accommodation for the dock crew. At each end of the two walls there are two steam boilers, making eight in all, which have been built at the Neptune Works of Messrs. Swan, Hunter & Wigham Richardson. Steam driven pumps of the centrifugal type which control the lifting of the dock, supplied by Messrs. Gwynnes, of Hammersmith, are placed at the base of the side walls.

At the end of one of the side walls is situated the valve house. From here, by means of electric pneumatic valve control gear, water level indicators and a complete telephone system to all parts of the dock, the dockmaster can take complete control. On the top of each wall there is a five-ton electric traveling crane and four powerful steam capstans to warp ships into the dock. The spaces in the interior of the walls are lit electrically while the outside of the dock is illuminated at night by large arc lamps and portable lamp clusters. In one of the walls of the dock large and well equipped workshops comprising a forge, machine shops and fitting shops, are installed. A complete electric generating plant is installed in each wall, which supplies current for lighting and ventilating the dock and the battleship which may be in the dock. The dock is, therefore, self-contained and will represent an addition to the navy of great importance.

June Ore Shipments.

Ore shipments during June were 7,567,555 gross tons, which is an increase of 2,747,559 gross tons over June, 1911, and also an increase of 250,963 tons over the movement of June, 1910, which was the record movement for an early month. Shipments to July 1, 1912, total 13,690,671 tons, which is only 1,227,587 tons less than the movement to July 1, 1910, when the record movement for the year was made. It is the expectation that the 1910 movement will be rapidly overtaken and the year 1912, notwithstanding the fact that it is a presidential year, will be a record-breaker. Shipments by ports were as follows:

	To July 1, 1911.	To July 1, 1912.
EAST BOUND.		
Copper, net tons	38,181	30,689
Grain, bushels	10,430,087	18,666,378
Building stone, net tons	1,352	2,282
Flour, barrels	1,717,918	2,028,112
Iron ore, net tons.....	8,241,337	12,925,044
Pig iron, net tons......	10,088	....
Lumber, M. ft. B. M..	159.321	178.695
Wheat, bushels	22,438,516	47,680,158
Unclassified freight, net tons	27,661	73,930
Passengers, number ...	6,885	5,994
WEST BOUND.		
Coal, anthracite, net tons	520,000	224,908
Coal, bituminous, net tons	3,689,282	3,715,397
Flour, barrels	125	....
Grain, bushels	....	....
Manufactured iron, net tons	118,060	197.811
Iron ore net tons......	9,486	3.188
Salt. barrels	236,477	295,687
Unclassified freight, net tons	397,598	336,950
Passengers, number ...	8,655	7,197
SUMMARY OF TOTAL MOVEMENT		
East bound, tons......	9,624,131	15.329,385
West bound, tons......	4,769.561	4,521,385
	14,393,692	19,850,770
Vessel passages	5.214	6 783
Registered tonnage, net	11,470,473	16,395,913

Lake Erie Ore Receipts.

Out of a total movement of 7,567,555 tons of iron ore during June, 5,816,493 tons came to Lake Erie ports, distributed as follows:

Port.	June, 1912.
Buffalo	687,283
Erie	41,124
Conneaut	1,419,562
Ashtabula	1,202,135
Fairport	283,520
Cleveland	1,201,475
Lorain	630,134
Huron	94,161
Sandusky	.....
Toledo	158,572
Detroit	98,727
Total	5,816,493

J & L Chain Catalogue

The Jones & Laughlin Steel Co. has certainly reached high water in the production of its new catalog on chains and attachments. It is a work of art in printing and binding and as such will undoubtedly be preserved for its workmanship. It is bound in russet leather, printed on fine stock with gilt edges. The illustrations are in double tint, showing in picturesque fashion the making and testing of chains. The chapter headings, beautifully designed, are printed in three colors. In illustrating the various grades of chain a new departure is noticed in the showing of several sizes of each style of chain, thus giving a sense of comparison and also in extending the illustrations to the page margins. One chapter is devoted to the care of chains, one to testing and inspecting J. & L. chains, and others to hand and machine chains and data concerning chains.

The Modern Boiler Tube

The National Tube Co., Pittsburgh, Pa., has just sent to the trade its booklet entitled "The Modern Boiler Tube." The booklet is a story of the evolution and development of the boiler tube. As known the company devotes its entire attention in the boiler tube line to the manufacture of steel tubes, both lap-welded and seamless. Specifications are published for these tubes for both merchant and marine service, including National Tube Co.'s specifications, American Society for Testing Materials and the full report of the special committee on steel vs. iron flues read before the International Master Boiler Makers' Association at its 1909 and 1910 conventions.

Commerce of Lake Superior

During June 10,747,159 net tons of freight passed through the canals at Sault Ste. Marie, an increase of 1,810,466 tons over the May movement. The movement marks a most substantial increase over that of 1911, when 7,476,087 tons were moved. The movement to July 1 was 19,850.770 tons as against 14,893,692 tons for the corresponding period last year, an increase of 4,957,078 tons. Following is the summary:

Port.	June, 1911.	June, 1912.
Escanaba	538,168	849,059
Marquette	314,807	561,976
Ashland	394,555	811,029
Superior	1,629,112*	2,348,608
Duluth	1,102.979	1,551,214
Two Harbors	840,345	1,445,669
Total	4,819,996*	7,567,555
1912 increase		2,747.559

Port.	To July 1, 1911.	To July 1, 1912.
Escanaba	1,067,708	1,641,948
Marquette	533,738	918,890
Ashland	662,412	1,332,891
Superior	2,944,954*	4.344,331
Duluth	2,050,134	2.845,478
Two Harbors	1.577,426	2 007,223
Total	8,836,372*	13,690,671
1912 increase		4,854 299

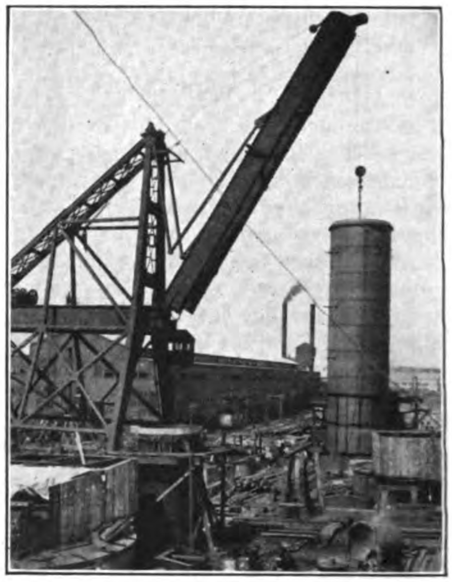
*Corrected.

The Fifth Monitor

Five vessels of the monitor type of construction will shortly be in commission, Osbourne, Graham & Co., Sunderland, England, having just launched one to be known as the Nervion, for Fearnley & Eger, of Christiana, Norway. Louis Zollner, managing director of the Monitor Shipping Corporation, declares that the monitor design, both scientifically and practically, held the field as the finest type afloat for carrying capacity, steadiness, economy and profit earning.

Lowering Rivadavia's Stack

The accompanying photograph shows the after stack of the battleship Rivadavia being lowered in place



LOWERING AFTER STACK RIVADAVIA

at the yard of the Fore River Ship Building Co., Quincy, Mass., on June 5. This stack is 58 ft. 4 in. long, 14 ft. 6 in. diameter and weighs 26 tons

The Niagara Navigation Co. and the St. Lawrence River Steamboat Co., which are now owned and operated by the Richelieu & Ontario Navigation Co., have elected the following officers: President, Sir Rodolphe Forget; vice president, William Wainwright; vice president, C. J. Smith; secretary, F. Percy Smith. C. J. Smith, as vice president and general manager, will have full charge of the property.

The Thousand Island Steamboat Co. has also elected Sir Rodolphe Forget as president, C. J. Smith as vice president, and F. Percy Smith as secretary, with C. J. Smith in general charge.

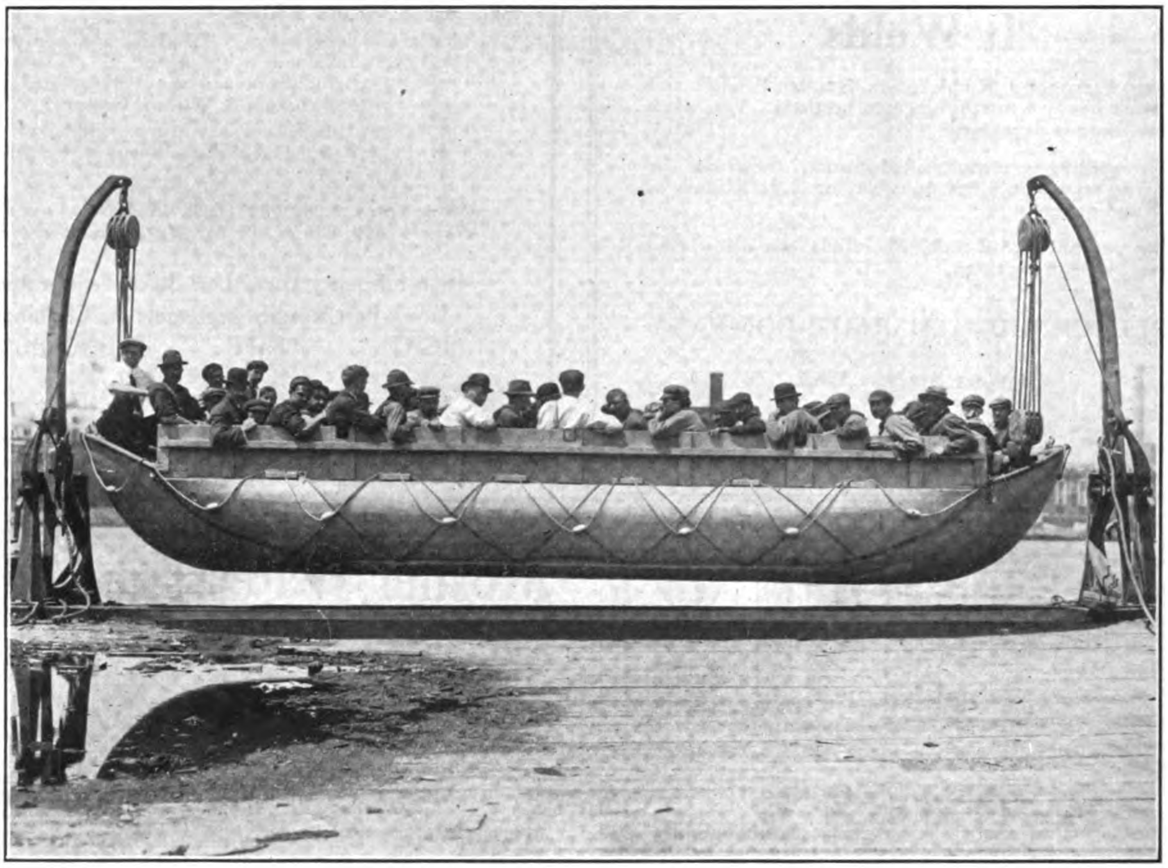
Welin Davits

The ill-fated Titanic was fitted with Welin davits of the double-acting type and could have carried three times as many lifeboats as were actually on hand. As a matter of fact there were three boats under one set of davits, all three of which were successfully launched one after the other, as well as two boats under another set. The officers of the Titanic testified that owing to the list of the ship it would have been impossible to launch the boats on the high side without the modern davits. It is admitted by practical men that the Welin davit embraces features that are most important and desirable in launching apparatus, that is, to be able to swing a boat outboard with the passengers in their places under any conditions whether the ship is listed or upright or rolling; to be able to keep the boat close to the ship's side when lowering to prevent its being crushed in; to be able to arrange the falls so that the boat will land in the water horizontally no matter what the angle of the deck line may be; to be able to detach the boat instantly and push her away from the ship's side at once. Launching a lifeboat is a far more serious problem than the layman thinks, as a large lifeboat fully loaded may weight from six to 12 tons.

Much stress has been laid in uninformed quarters on the importance of having much clearance outboard for the davits, sufficient to prevent the boat from touching the ship's side. Obviously this would mean a clearance equal to the distance from the water line to the top of the davits, which on large liners would mean from 80 to 90 ft. Clearance is not as important as control when the boats are close to the ship's side. By having control of the boat as it is lowered, the ship's side helps to steady and support it on its downward way, and it is prevented from swinging out far enough that an onrushing wave could smash it against the side of the ship.

One objection made against the Welin davits by ship builders particularly is their weight as against the lightness of the decks of vessels of the lake and coast type. As a matter of fact the weights of the Welin davits are 10 per cent less than those of round bar davits for boats of the same capacity, and in most cases it will be found that the slight reinforcement necessary to take the Welin davits would not equal this difference in weight of the davits themselves. However, the proper thing to do would be to build the deck strong enough in the first place to take davits which would be of actual use when life boats are needed. Lifeboats are useless unless they can be safely and rapidly launched and the Welin davit appears to have solved this problem. Moreover, as it is possible for a single set of Welin davits to handle two and even three boats, there should be no difficulty in carrying lifeboat accommodations to meet all reasonable requirements.

The La Salle Machine & Tool Co., La Salle, Ill., are the agents for the Welin davits on the great lakes.



LUNDIN DECKED LIFEBOAT, WITH 60 PERSONS, UNDER THE WELIN DAVITS

The Cunard liner Carmania, which was the first Cunard steamer to be fitted with turbine engines and the success of which induced the Cunard Co. to adopt this form of propulsion for the Mauretania and Lusitania, was greatly damaged by fire at Liverpool. The fire raged for several hours before it was extinguished and practically destroyed the superstructure of the vessel. The Carmania is seven years old and until the advent of the express steamers, Mauretania and Lusitania, was the finest vessel in the Cunard service.